NOVEMBER, 1958

WIRE AND WIRE PRODUCTS

WHEN *Continuous Operation*

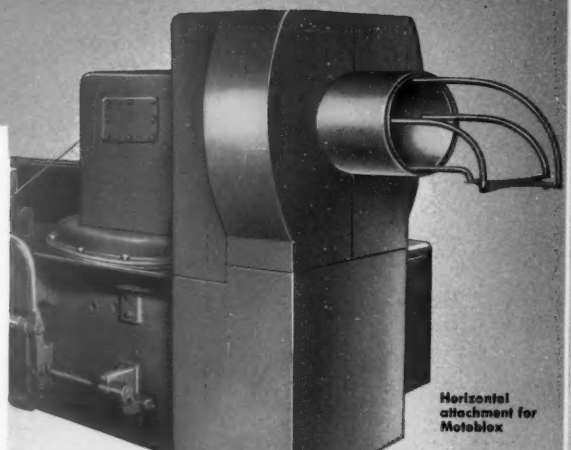
IS DESIRED FOR COILS
UP TO THE LARGEST BUNDLES...

INSTALL

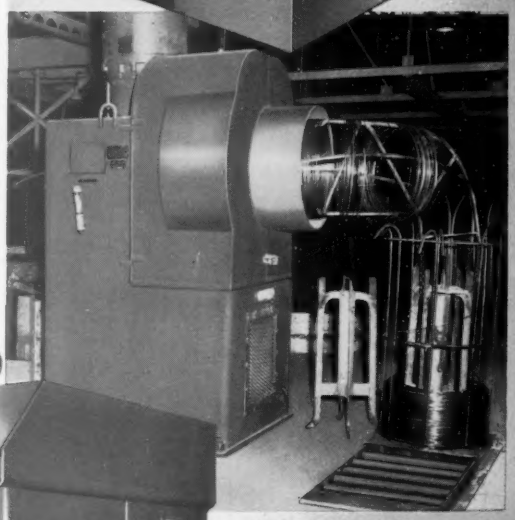
Vaughn®

STATIONARY BLOCKS

on your OLD or NEW MACHINES



Horizontal attachment for Moteblox



Horizontal air-cooled unit finishing .086 spring wire with HRM Moteblox

Vertical type, for coiling galvanized wire

Available as integral attachments to new or existing drawing machines, or as separate floor-mounted units for use with drawing machines or as take-ups in processing lines, Vaughn Stationary Blocks permit continuous operation for production of coils of any size up to the largest bundles. Complete details on the many models of Vaughn Stationary Blocks in both horizontal and vertical types—for drawing, coiling, or both—will be provided promptly on request.

The Vaughn Machinery Company
Cuyahoga Falls, Ohio

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys

V®

"Quick on the Draw!"

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

D-PAK

COULTER & McKENZI

FINE WIRE D-PAKERS

CONSTANT CONTROLLED TENSIO

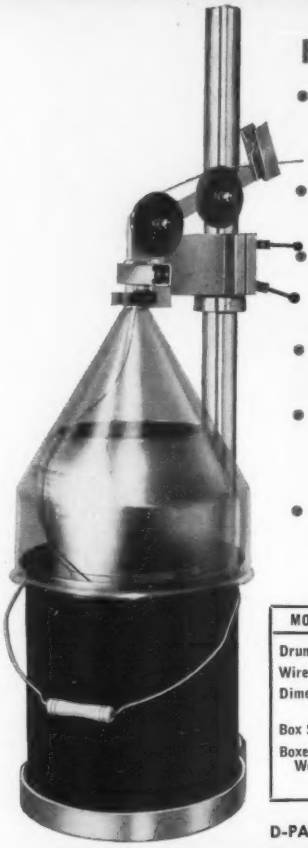
ATTACHMENT TYPE

D-PAK 100
Illustrated

- Meets all conventional industry D-Paking requirements
- 360° floor plane setting
- 180° vertical lead-in guide adjustment
- Snaps on both fibre and steel
- Shipped complete with dampening ring

MODEL	D-PAK 40	D-PAK 100
Drum Size	8"	11"-11¼"
Wire Sizes	AWG 27 and finer	AWG 17-30
Dimensions	9" Dia. X 14½" high	11½" Dia. X 16"
Box Size	10" X 10" X 18" high	12" X 14" X 20"
Boxed Weight	5 Lbs.	6 Lbs.

FLOOR TYPE



- Designed for D-Paking o wires at higher speeds wit closer control
- Base may be permanentl fixed
- Vertical height and hori zontal plane settings ma be fixed
- Adjustable for various wir sizes
- Swing top arm for ease o drum change and positiv reset
- Dual capstans give greate range of tension adjustme

MODEL	D-PAK 40-A	D-PAK 100-A
Drum Size	8"	11-11¼"
Wire Size	AWG 27 and finer	AWG 17-30
Dimensions	9" X 12" X 34" high	12½" X 17" X 0 high
Box Size	10" X 13" X 35"	13" X 18" X 44"
Boxed Weight	20 Lbs.	33 Lbs.

D-PAK 100-A, *Illustrated*

ACCESSORIES

TENSION CLIP

- Spring Loaded
- Reversible Wiper Felts

SIZE	CLIP
Dimensions	1" X 3"
Net Weight	¼ Lbs.

CORE BALL

- For Use with Floor Type D-Pa

SIZE	BALL 40	BALL 100
Core Diameter	6"	8"
Net Weight	1½ Lbs.	2 Lbs.

FRICTION CAPSTAN

- Adjustabie Tension
- Precise Control

SIZE	CAPSTAN #1	CAPSTAN #2	CAPSTAN #3
Dimension	4⅜"	3-7/16"	2¼"
Wire Size	10-23 AWG	17-30	24-37
Net Weight	3 Lbs.	1 Lb.	½ Lb.

DAMPENING RING

- For Use with Attachment Type D-Pak

SIZE	RING 40	RING 100
Core Diameter	6"	8"
Net Weight	¾ Lbs.	1 Lb.

PATENTS PENDING

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F.O.B. BRIDGEPORT, CONNECTICUT

35 UNION AVENUE

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THE COULTER & McKENZIE MACHINE CO., INC.

SINCE 1843 — BRIDGEPORT 7, CONNECTICUT, U.S.A. — INCORPORATED 1881

"America's Finest Wire Draw"

ANNOUNCES A GREAT NEW LUBRICANT!!!

Number 122

No. 122 is a complex high titre soap, incorporating "E. P." additives.

No. 122 produces a tough, dense and uniform coating.

No. 122 does not require any special die practices.

No. 122 is completely adaptable for drawing mechanically descaled rod and wire one or more drafts.

No. 122 produces a finish eminently satisfactory for wire to be galvanized, painted and welded.

No. 122 produces an especially good uniform coating for wire to be oil tempered on a light-limed rod.

No. 122 is a mill tested and approved lubricant.

"Look to Standard for the Future"

Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.

Cordially yours,

Standard Industrial

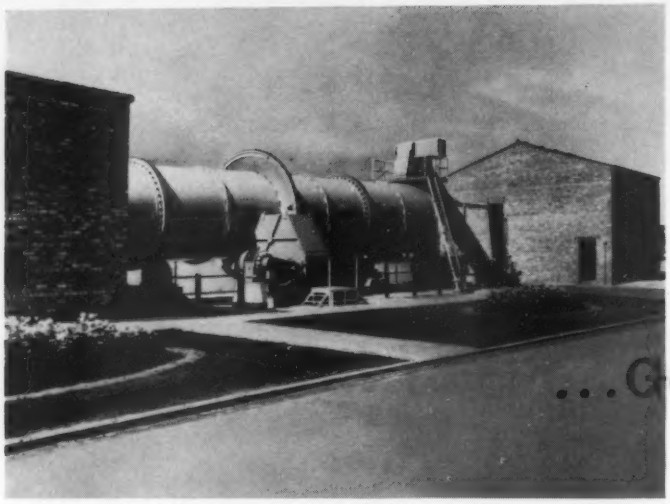
COMPOUNDS CO., INC.

Member WAS

FRANKFORT, ILLINOIS

(A suburban Chicago area city)

Telephones: 2131 - 2141



...Generally speaking

The above illustration shows the huge "Dano" refuse and composting plant at Edinburgh, manufactured at our works and erected by our own personnel.

our first products were not of a general nature but were speciality equipment for the neighbouring paper-making industry. Being general engineers, however, in so far as we were always alive to any opportunities for developing new types of product we steadily expanded and consolidated until we had customers and plant in almost all parts of the world. And this process is continuing today.

It is rather strange how varied our products and services have become yet all are interconnected with each other in some way or another. For instance allied to our first products we manufacture stretching, conditioning and varnishing machines for paper for the insulation of electric transformers and cables. Closely involved in the impregnation of the paper insulated cables, etc., is high vacuum equipment, a branch that has unlimited applications in industry, and medical and scientific laboratories. Then again, machinery for the rubber and plastic insulation of electric cable, from fine distribution cable up to large power cable, is yet another of our specialities.

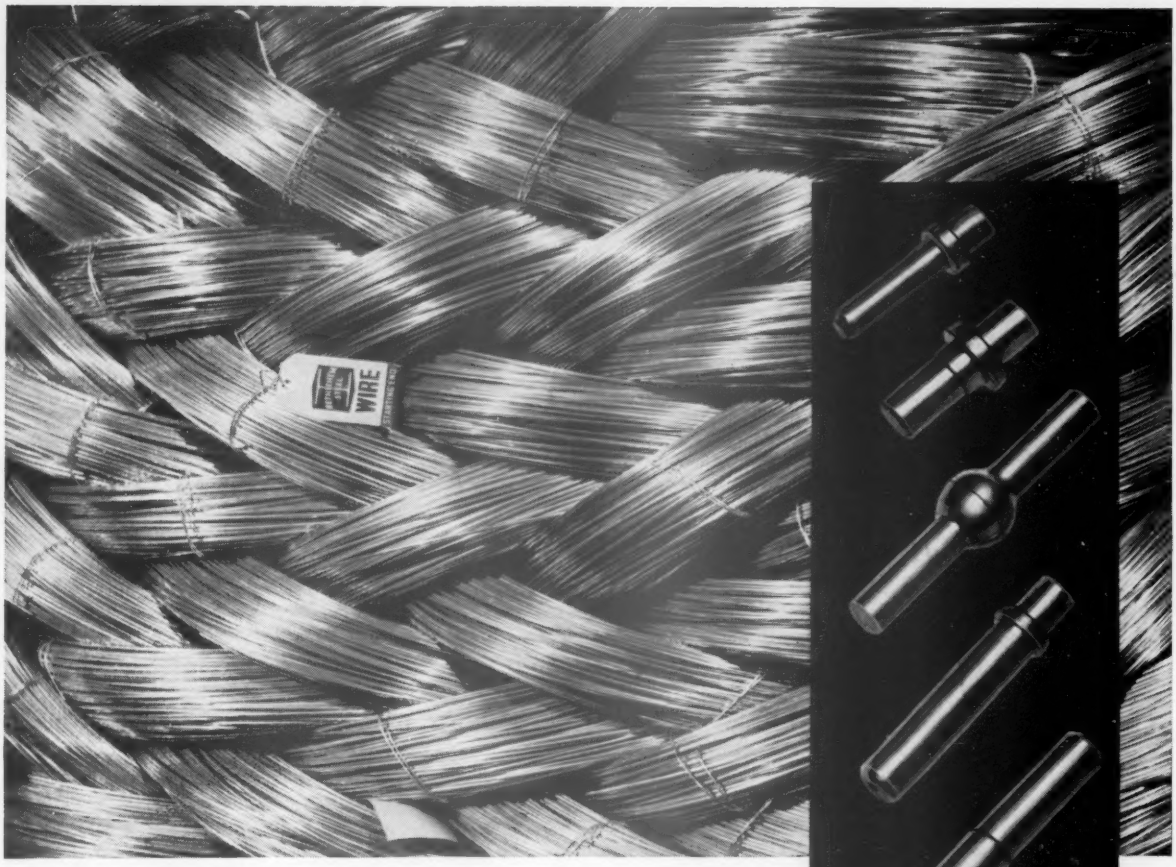
Handling infinitely sensitive and highly accurate equipment on the one hand and enormously large structures weighing scores of tons on the other is all part of our work. If you are only merely interested send for a copy of our "Summary of Products" leaflet. You might find that we may be able to help you sometime.

General Engineering Company (Radcliffe) Limited

Station Works, Bury Road, Radcliffe, Lancs., England

Telephone: Radcliffe 2291 (4 lines) Telegrams: "General", Radcliffe, Manchester

Represented in nearly every country in the world



How to be sure you're using the right cold-heading wire

It pays to be fussy about the grade of cold-heading wire you use in operations like upsetting, forging or roll-threading. The job is half licked when you start with the correct type of steel wire.

Steel wire for cold-heading is a Bethlehem specialty. There are many ways in which our experience might prove helpful in bettering your production of cold-headed items.

At your invitation we will gladly study your products, equipment and process . . . and recommend the grade of steel that will perform the best. Then we'll carefully produce the steel to meet your needs.

Bethlehem cold-heading-quality wire is made to rigid standards. It is uniform in analysis and free from injurious surface defects. Thorough inspection at every stage of production typifies the quality-control that's behind every ton we ship.

One of our technical men will be glad to discuss cold-heading with you—or any other application of steel wire. Bethlehem makes nearly all kinds of steel wire. Just phone the nearest Bethlehem sales office, or drop a line to the address below.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

New Breakdown Unit Produces Both Heavy And Light-Intermediate Finished Sizes

Syncro Introduces Cold Wire Drawing Equipment Featuring 21 Die Positions

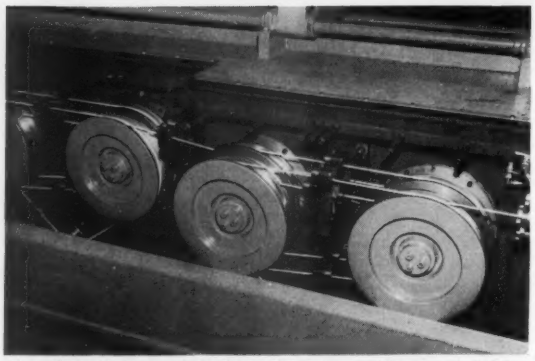
The new J-21, designed and introduced to offer greater flexibility in non-ferrous wire production, gives wire manufacturers the largest number and selection of die positions available in any American-built rod breakdown machine.

With a maximum number of 21 die positions, J-21 produces both heavy and light-intermediate finished wire sizes ranging from #8 to #24 Brown and Sharpe gauge. Maximum size of entering soft copper rod is 5/16″ diameter.

In addition to the large number of die positions, the new Syncro machine incorporates precision-made parts reflecting the finest in quality and workmanship. Draw blocks are furnished with replaceable steel wearing rings.

The machine housing consists of a heavy steel weldment adequately proportioned to provide a mounting for all pull block assemblies, gear drives, die holders, etc. The housing incorporates a large drawing compartment to allow sufficient area for compound distribution.

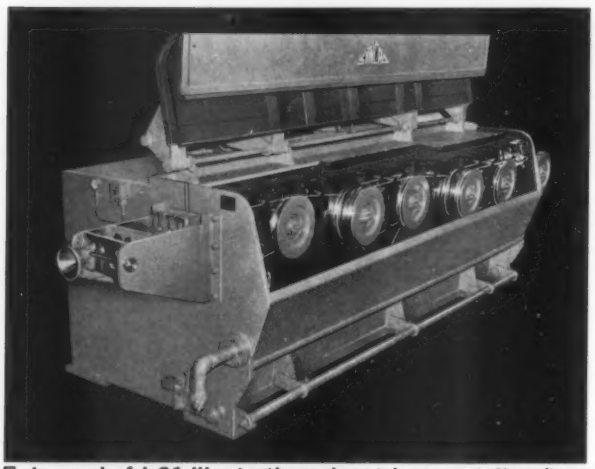
A moveable double capstan and special gear transmission are among other engineering features of the J-21. The capstan arrangement allows a total of eight finishing speeds. The maximum recommended finishing speed is 5000 FPM.



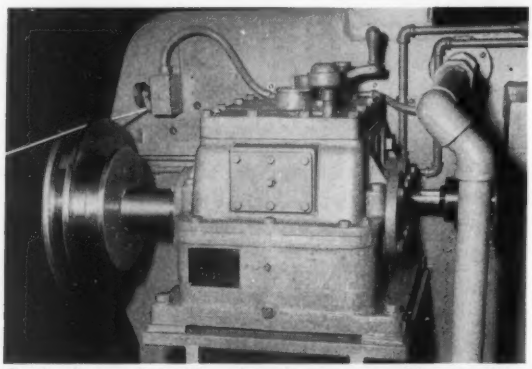
Number 4, 5 and 6 draw block sections of J-21, showing adjustable die holders and string-up.

J-21 is Syncro's latest addition to the machine company's line of cold wire drawing equipment famous the world over.

A detailed description and specification sheet on the J-21 Rod Breakdown machine is now available. Direct your request for bulletin 102S to Syncro Machine Company, Dept. C, 611 Sayre Avenue, Perth Amboy, New Jersey.



Entry end of J-21 illustrating wire string-up, tallow box, and jog switch.



End view of J-21, showing moveable double capstan, and capstan transmission.

SYNCRO MACHINE COMPANY

Perth Amboy, New Jersey, U.S.A.

affiliated company: WINGET SYNCRO Ltd. Rochester Kent, England

SYNCRO®

Better Machinery for the Wire Industry

WIRE DRAWING MACHINES • STRANDERS • CONTINUOUS ELECTRIC ANNEALERS • PAYOFFS • CAPSTANS • WIRE INSULATORS • HEAVY DUTY TAKEUPS • TAPERS • SPECIAL MACHINERY

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 33 November, 1958 No. 11

Designated as Official Publication By The Wire Association

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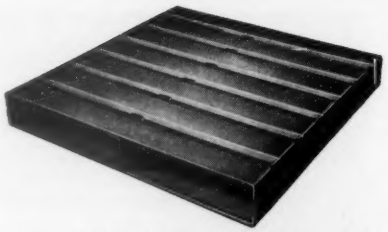
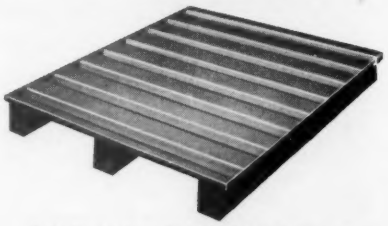
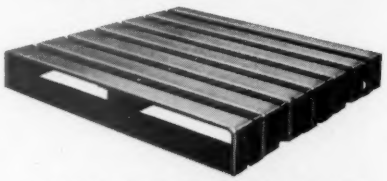


P-14 Double Face Steel Pallet.



P-12 Single Face Steel Pallet with two- or four-way entry.



P-16-S Semidouble Face Steel Pallet for use with trucks with retractable wheels as well as fork-lift trucks.

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Pallets

GIVE YEARS OF EFFICIENT SERVICE AT MINIMUM COST

Republic Steel Pallets are designed to eliminate maintenance expense — designed to eliminate broken deck boards, protruding nails, split stringers and joint failures.

They are strong and rigid with minimum weight. There are no sharp edges or projections to damage materials being handled or to injure workmen.

Pallet styles illustrated are typical examples only. Republic Engineers are available to work with you in the development of a pallet design to meet your individual requirements.

REPUBLIC STEEL CORPORATION
BERGER DIVISION
DEPT. K-8767-A
1144 BELDON AVENUE, N. E. • CANTON 5, OHIO

( ) Please send Steel Pallet Catalog.
( ) Have an Engineer call.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

K-8767

U.S.I.

Vol. II, No. 5

POLYETHYLENE PROCESSING TIPS

HOW CARBON BLACK QUALITY AFFECTS WEATHER RESISTANCE OF POLYETHYLENE

For cable jacketing and many other outdoor applications polyethylene offers substantial advantages over other materials. It is subject, however, to degradation from long exposure to sunlight unless the resin is properly protected.

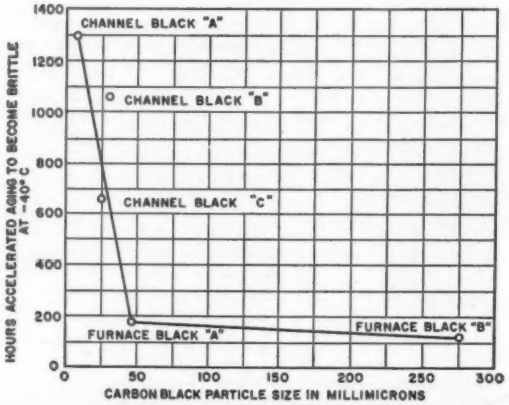
Actually, the aging of polyethylene is the result of a chemical reaction with atmospheric oxygen. Catalyzed by the ultraviolet rays in sunlight, this reaction proceeds more rapidly in outdoor use than is the case with indoor applications. The principal effects of aging are to increase brittleness at low temperature, and to decrease the resistance to stress cracking.

Carbon black dispersed throughout the polyethylene greatly retards this aging, or weathering. However, not all carbon blacks produce the same degree of weather resistance when dispersed in polyethylene. Moreover, the care with which the carbon black is dispersed in the polyethylene is vitally important.

The weather resistance of a polyethylene compound depends on: (1) type and particle size of carbon black; (2) percentage of carbon black in the compound; (3) the dispersion of the carbon black in the polyethylene.

Accelerated aging tests have been devised to approximate the action of years of outdoor exposure.

The graph below shows the great difference in number of hours required in these tests for a polyethylene to embrittle at –40°C when various carbon blacks having different particle sizes are used.



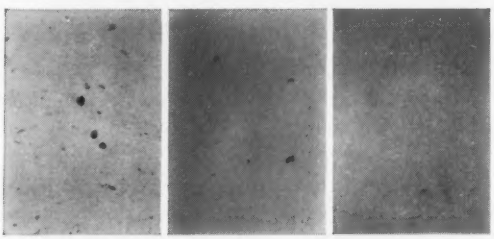
EFFECT OF CARBON BLACK PARTICLE SIZE ON ACCELERATED AGING OF POLYETHYLENE.

The two at right are "furnace blacks", and it will be noted that they are comparatively ineffective. The three at the left are "channel blacks", and obviously, they are many times more effective. This is due to their much smaller particle size – from about 10 to 25 millimicrons, against 50 to 275 millimicrons for furnace blacks.

Weather resistance also increases with the concentration of carbon-black – up to a point. Beyond this point the light screening effect is offset by a decline in other properties.

DEGREE OF DISPERSION IMPORTANT

Carbon black gives maximum protection only when it is thoroughly dispersed in the polyethylene. This presents a difficulty because the smaller the particles, the greater is their tendency to collect into clusters which, once formed, are hard to break up. Tests show that a good dispersion will withstand 15 to 20 times as much exposure to sunlight as a poor dispersion.



POOR FAIR GOOD

MICROPHOTOGRAPHS OF CARBON BLACK DISPERSIONS IN POLYETHYLENE.

The wire and cable grades of U.S.I.'s PETROTHENE polyethylene resins employ only the finest "channel black" carbon black. Concentration is set at a point which yields the optimum balance of light screening and other properties. Special processing equipment insures thorough dispersion. The result is black polyethylene that withstands long, severe outdoor exposure, yet affords the practical maximum of tensile and other properties.

If you fabricate or use black polyethylene, ask U.S.I. for complete technical data on PETROTHENE resins expressly formulated for weather resistance.

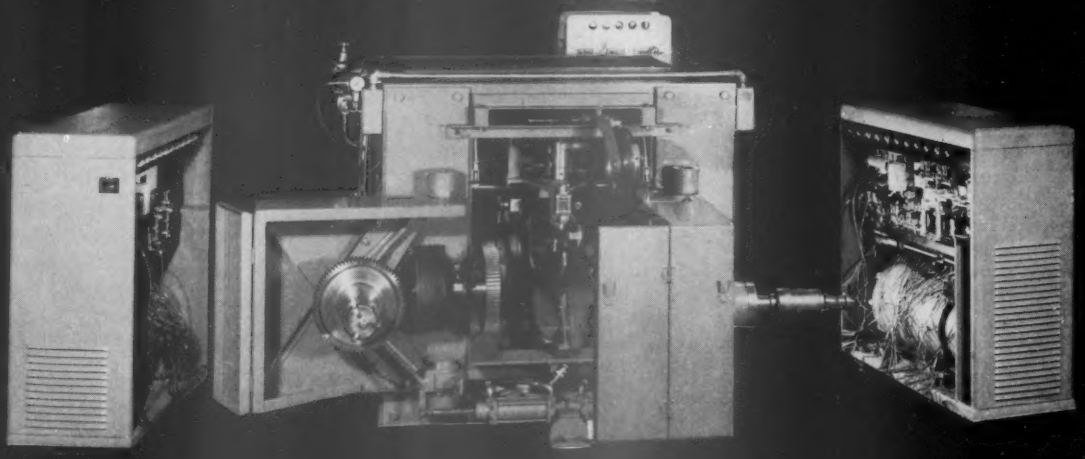
U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

24-HOUR AUTOMATED WIRE PRODUCTION

WITH THE NEW

LITZLER TRANSFER ★ MATED

DRAWING MACHINE TAKE-UP



★ Round-the-clock winding of all non-ferrous wire types at speeds to 5000 FPM.

★ Rugged electronic control and individual drive systems provide instantaneous transfer between dual reels—automatically!

★ Electronically measured winding of 24" or 36" reels precisely synchronized with drawbench speed and tension.

★ Pneumatic reel clamping and automatic unload-position reel delivery . . . can be arranged for end-out winding . . . adaptable to most existing drawing equipment.

C. A. LITZLER CO., INC.

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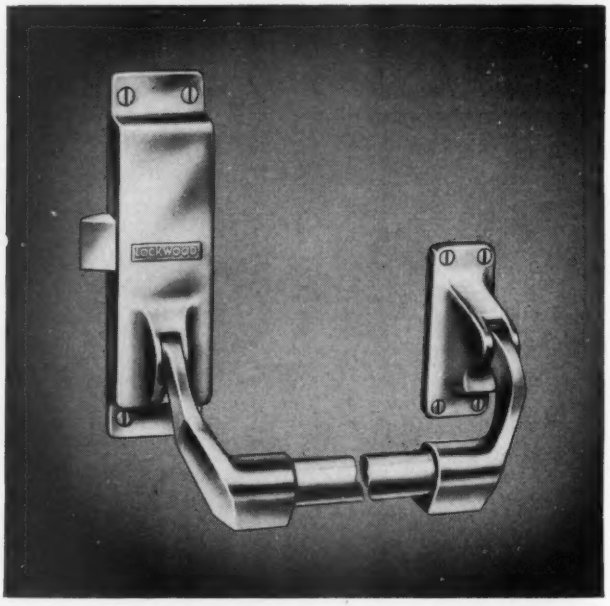
EXPORT REPRESENTATIVE: GILLESPIE & CO. OF N. Y., 96 WALL ST., NEW YORK 5, N. Y.

Fire!

. . . and USS American Music Wire

CRUCIAL. In the hands of a skilled workman the vital spring goes in place in the Lockwood "Lock 'n Roll" panic exit device. In times of emergency and panic the lives of thousands of people depend upon the unfailing action of this little spring.



EVER READY to release and open the door at the lightest touch. Held in place in the "Up" position by the spring of USS American Music Spring Wire, this panic latch will open easily, smoothly at the touch of a finger tip.

CROWDS of children leaving a burning school—their safety depending upon the open door and on the smooth, perfect operation of the panic opening device. Latches of this kind are designed to meet and pass a supreme test of efficiency—a test they will probably never need to undergo. But should an emergency occur, the latch must operate completely and perfectly.

Because this "Lock 'n Roll Latch" panic exit device serves so vital a purpose, because it must give long, unfailing service, must open easily, instantly every time it is touched, the Lockwood Hardware Manufacturing Company, Fitchburg, Mass. spares no effort in design, manufacturing and selection of material to make this latch as perfect as possible.

For the latch to operate properly, the cross bar must remain in the "Up" position, ready to release the door at the lightest touch. To hold the bar in this position is the job of a very vital, specially designed spring—made of USS American Music Spring Wire.

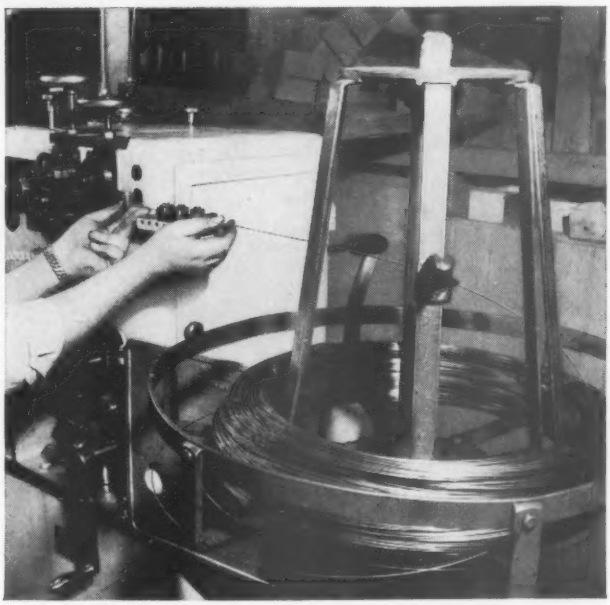
In their search for a wire to make the spring for the panic exit device, the Lockwood Hardware Manufacturing Company selected USS American Music Spring Wire for its complete dependability, its consistent uniformity and its superior quality. The experience gained in 125 years of wire drawing and manufacturing has stood American Steel & Wire in good stead in supplying the high-quality Music Spring Wire required by the Lockwood Hardware Manufacturing Company.

If you have a product involving the use of spring wire or any other type of wire, get in touch with American Steel & Wire. The same controlled quality, dependability, and uniformity are available to every fabricator who uses USS American Manufacturers Wire in the products he produces. Just write to American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

American Steel & Wire Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

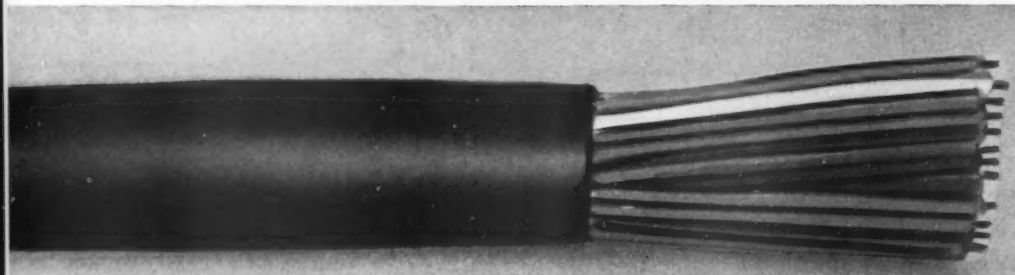
makes sure the door opens!



8,000,000 A MONTH. Shown here USS American Music Spring Wire is being fed into a Sleeper & Hartley spring coiler. The Lockwood Company uses ten spring coilers and one torsion machine to produce the 8,000,000 springs they use a month.

INSPECTION. Important final inspection for Lockwood spring assures that this spring will have the necessary dependability and reliability to meet the rigid requirements of a panic door exit device used on schools and other buildings.

THE MESSAGE IS: MONSANTO



OPALON 1101, "engineered" for primary insulation of switchboard cable by high resistance to cut-through, and excellent deformation resistance.

*your source for "engineered" **vinyl** telephone insulation compounds*

Communications wire and cable manufacturers like the "engineered" choice offered by the Monsanto Opalon series of vinyl compounds, designed and developed for individual application requirements.

For example: Opalon 1101, a semi-rigid vinyl compound for primary insulation of switchboard cable. Resistance to both cut-through and deformation: excellent. High gloss, smooth surface, great ease of extrusion, excellent heat stability and insulation properties, available in a broad range of colors.

Monsanto also offers a broad line of polyethylene insulating compounds. When you want a specific answer to an insulating problem, call in your local Monsanto representative. Write for complete technical data on Opalon vinyl compounds and polyethylene compounds to Monsanto Chemical Company, Plastics Division, Room 545, Springfield 2, Mass.

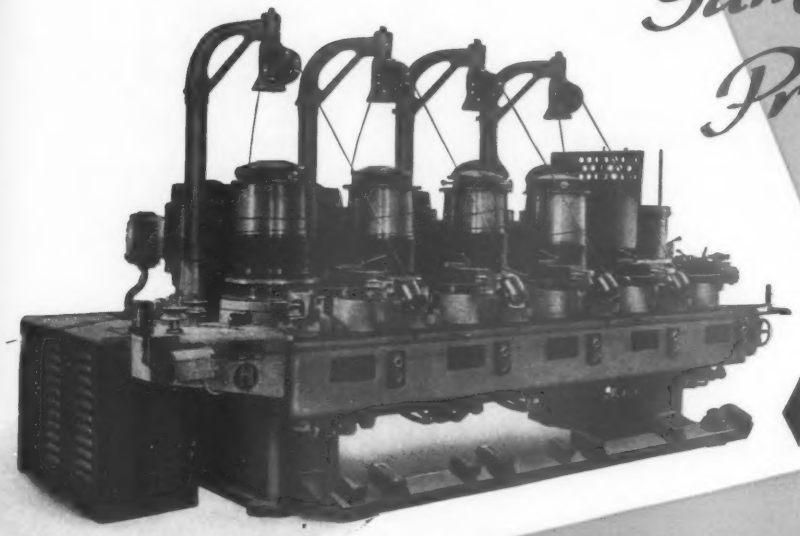
Monsanto

OPALON: REG. U.S. PAT. OFF.

HERBORN

Model G III
11 Drafts

Same Production, Half Space



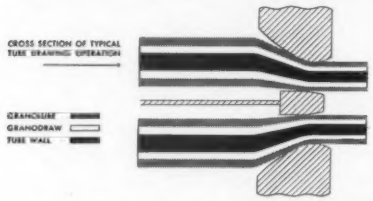
Model G III d
5 Blocks =
10 Drafts

MASCHINENFABRIK HERBORN BERKENHOFF & DREBES A.-G.
OUR SPECIALTY: MACHINES FOR THE WIRE INDUSTRY • IRON FOUNDRY
HERBORN (DILLKREIS) GERMANY
Sole Representative in the U.S.A.
KURT ORBAN CO., Inc., 34 Exchange Place, JERSEY CITY 2, N. J.
Sole Representative in Canada: PAUL REICHER, P. O. Box 127, Willowdale, Ont., Canada.

CHEMICAL CONVERSION COATINGS and their functions in facilitating the cold mechanical deformation of metals

By ARTHUR DAHL, Product Development Dept., AMCHEM PRODUCTS, INC.

When used to facilitate the cold mechanical deformation of metals (in drawing, extrusion, stamping, cold heading, necking, and upsetting operations) chemical conversion coatings in conjunction with suitable lubricants perform three important functions. One, they prevent metal-to-metal contact between work and tool. Two, they prevent galling and seizing. Three, they protect stock indefinitely, permitting the storage of in-process work at any stage of production, without danger of corrosion damage.



Characteristic of the tightly bound, highly absorptive, crystalline coating formed by the processes is the ability of the coating to retain lubricity throughout forming operations when treated with a suitable lubricant. This offers the following production advantages:

- **Higher degree of reduction**
- **Greater speed of draw**
- **Longer tool life**
- **Fewer process anneals and pickling**
- **Finer surface finish**
- **Cleaner mills**
- **Easier inspection of finished product**

Also of interest to production men is the exact duplication of coatings from batch to batch. And the processes are much simpler than other methods of coating metals—baths can be set up and running in less time than it takes to determine suitable coatings by other methods.

TYPES OF COATINGS AND THE METALS FOR WHICH THEY ARE DESIGNED

Zinc phosphate coatings for carbon steel. These coatings can be applied by either dip or spray systems.

Dip. ACP Granodraw No. 1 is typical of the dip process. The sequence includes precleaning, water rinse, pickling, water rinse, water rinse, Granodraw No. 1 solution, water rinse, and a hot neutralizing rinse. Surfaces to be treated must be free of oil, grease, rust and scale. The above sequence insures that they will be. And when metal is free of rust and scale, the pickling bath and two succeeding water rinses can be omitted. In either case, a lubricant like ACP Granolube or conventional lubricant must be applied prior to working the metal.

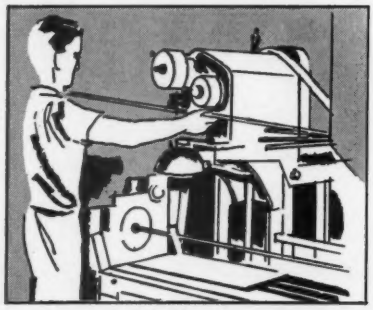
Spray. ACP Granodraw No. 4 is an example of the spray process. It usually requires 5-stage equipment and includes the following steps: precleaning, water rinse, Granodraw No. 4 solution, water rinse, lubricant. After chemical treatment, the work must be dried before forming.

Oxalate Coatings for the stainless steels and many of the high nickel alloys. These coatings are applied only by immersion process, and usually in a 5-stage system which includes an acid pickling or depassivating bath, a water rinse, the ACP Granodraw SS coating bath, a hot borax neutralizing rinse for wire stock, or a lubricating bath for tube stock. Since thorough activation of the metal surface is necessary to promote an adherent coating, the pickling and activating bath is an important stage in processing.

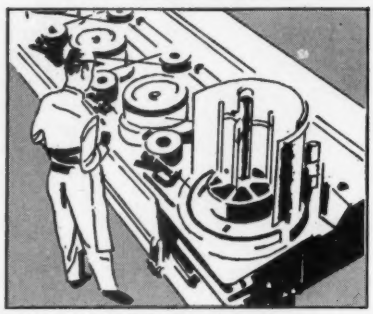
Fluoride-type coatings for zirconium and its alloys. Granodraw ZR is such a coating. It is applied in an immersion process which includes precleaning, water rinse, pickling, water rinse, Granodraw ZR solution, water rinse, drying or lubricating. It has been used primarily in the treatment of stock prior to wire drawing and tube drawing. Surfaces are cleaned of oil and grease by solvent degreasing or alkali cleaning. Pickling is required to provide a surface that is chemically and metallurgically receptive to the coating.

Strong alkali coatings for tantalum and amorphous phosphate coatings for aluminum. These two types of coatings are now in the development stage. Laboratory and field tests are being conducted, results are being evaluated, and modifications in chemical makeup and process sequence are being made to meet requirements. Several field tests, however, have indicated that they will do the same job for tantalum and aluminum processors as the other types of coatings have done for those working carbon steel, stainless steel, high-nickel alloy, and zirconium.

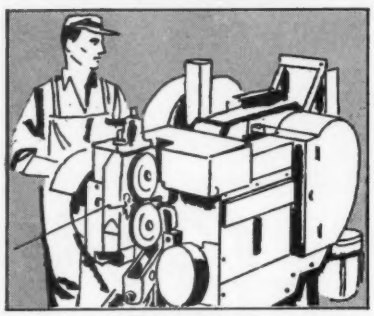
For more information write us at Ambler.



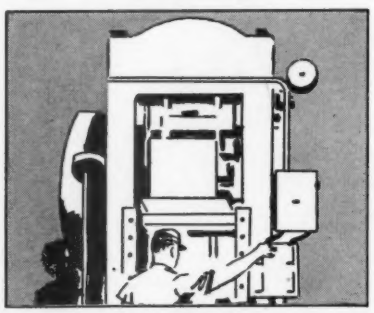
Tube Drawing



Wire Drawing



Cold Heading



Impact Extrusion

Note. Granodraw and Granolube are registered trademarks of Amchem Products, Inc.

Amchem Products, Inc. Ambler 30, Pa.

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We supply:

- Modern protective gas Annealing Furnaces for iron and steel wire, strip etc.
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- Top-heated Galvanizing Furnaces with everlasting ceramic tank
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Sole Representative:
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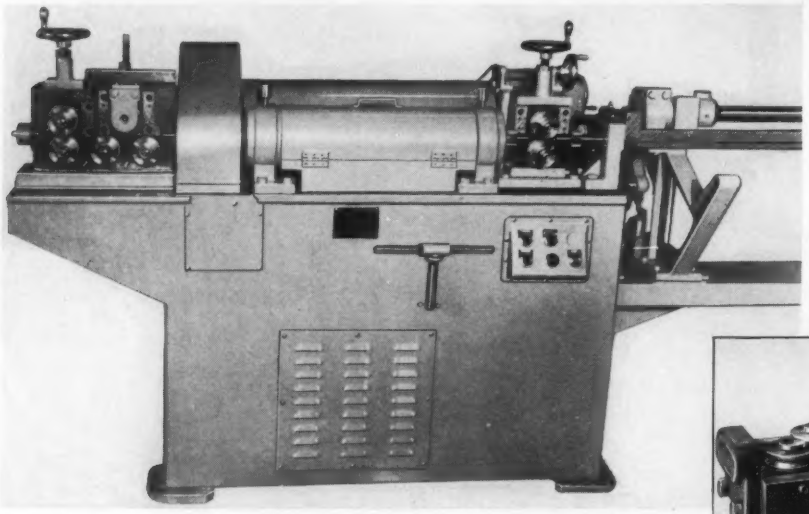
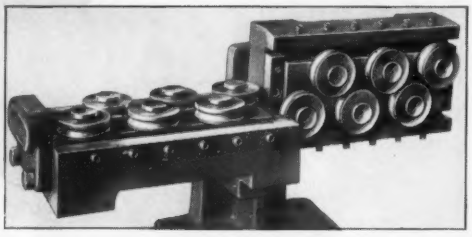
Machinery & Equipment
P.O. Box 127, Willowdale, Ont., Canada

If you use wire up to 3/8", this new SHUSTER is just for you!



Roll type straightener interchangeable with rotary arbor.



These new SHUSTER wire straightening and cutting machines incorporate new advantages to give you higher production—for less cost. The 2ABV variable speed unit straightens and cuts round wire from 3/16" to 3/8"; the 2ABVF straightens and cuts shape stock up to 1/4" square.

The new machines include an improved, vertical drive 5-roll gear driven preliminary straightening unit, and feed roll housing, both Timken bearing equipped. The new SHUSTER'S can automatically cut lengths up to 14" at the rate of 140 pieces per minute, and provide infinite variable speed within all feed and cutoff ranges. This machine may also be purchased as a constant speed unit (150 f.p.m.).

Want more details? Send this coupon today!

Gentlemen:

☐ Please send me complete specifications and prices on the 2ABV-2ABVF SHUSTER.

☐ Send me specifications and prices to meet the following wire straightening requirements: .....

.....

Name .....

Address .....

City ..... *State* .....

SHUSTER FEATURES:

1. **Higher speed five die straightening arbor, mounted on ball bearings for minimum vibration.**
2. **Electric trip mechanism on target.**
3. **Solenoid-operated roll-type clutch.**
4. **Electric control Panel—one position operation.**
5. **Totally enclosed feed roll housing and prestraightener with shafts mounted on Timken Bearings. Gears in oil.**
6. **Electric Brake on clutch shaft.**
7. **Wide range Reeves Variable Speed. 50 to 200 F.P.M.**
8. **Wire size range: 3/16" to 3/8" diameter basic wire.**
9. **Gear driven preliminary 5 roll straightener, mounted in vertical position.**

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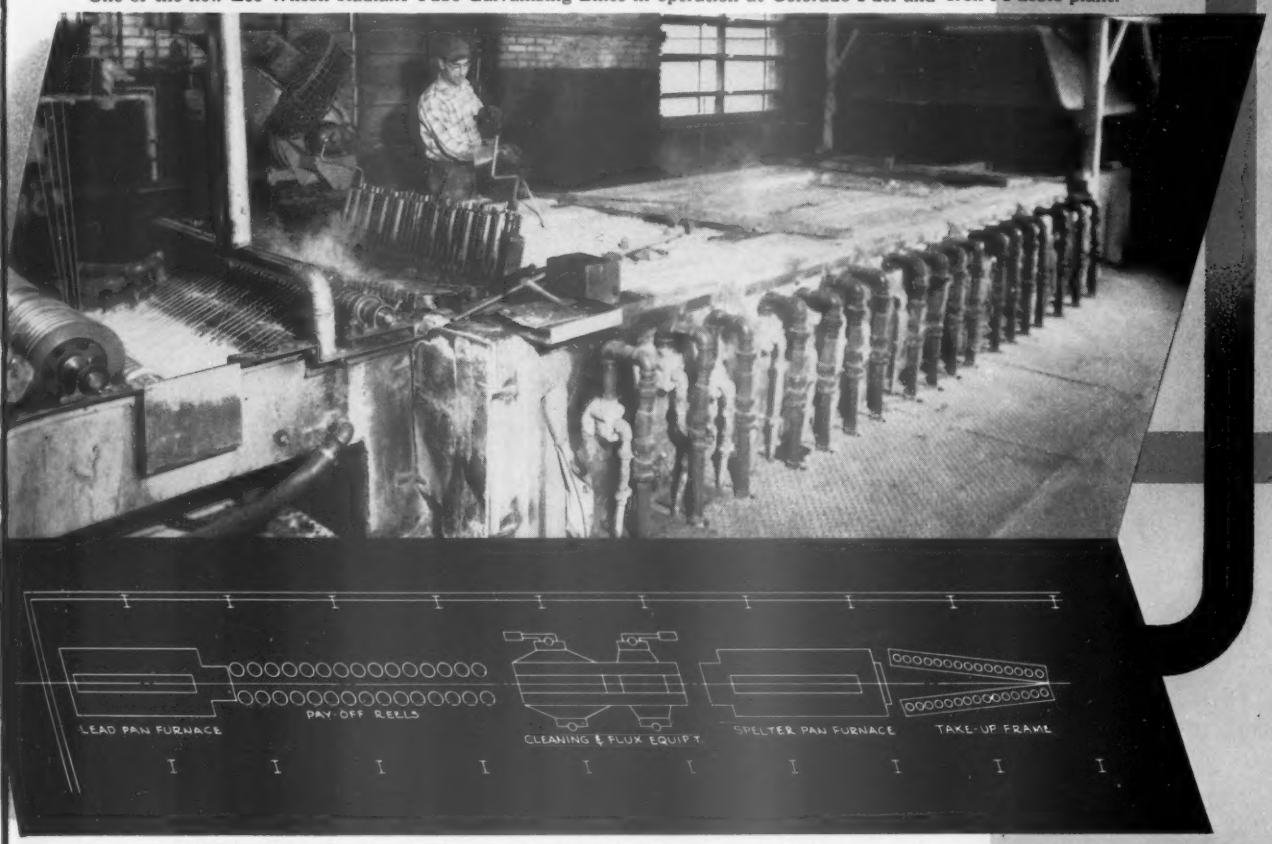
Lee Wilson RADIANT TUBE

Lead Annealing and Galvanizing Lines

One of the new Lee Wilson Radiant Tube Galvanizing Lines in operation at Colorado Fuel and Iron's Pueblo plant.

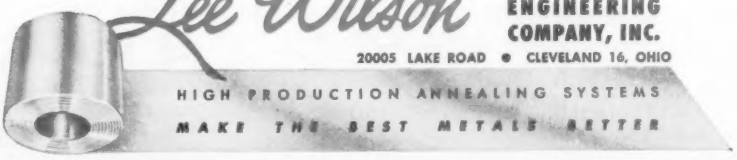


Arrangement drawing that shows how wire leaves pay-off reels, is directed over the lead furnace and back through the furnace, over the pay-off reels, where it cools sufficiently to enter rinse and flux and on into the zinc furnace.

doubles pot life—cuts drossage in half!

By adapting the radiant tube to lead and spelter pots, Lee Wilson engineers can greatly extend the life of this expensive equipment. And, because the radiant tube method keeps temperatures uniform throughout the pot, eliminating hot spots, drossage is reduced to a minimum. This adds up to better galvanizing, lower maintenance costs and greatly reduced line downtime.

If you are considering wire galvanizing with lead annealing, you should know about this vastly improved method. You can get the answers from your Lee Wilson representative or by writing direct.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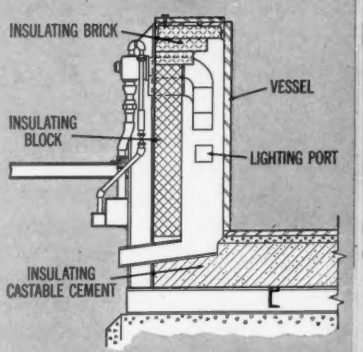
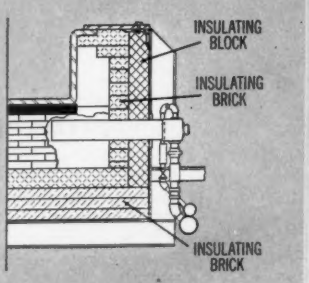
MAKE THE BEST METALS BETTER

* ORIGINATORS AND LEADING PRODUCERS OF OPENED COIL AND SINGLE STACK FURNACES

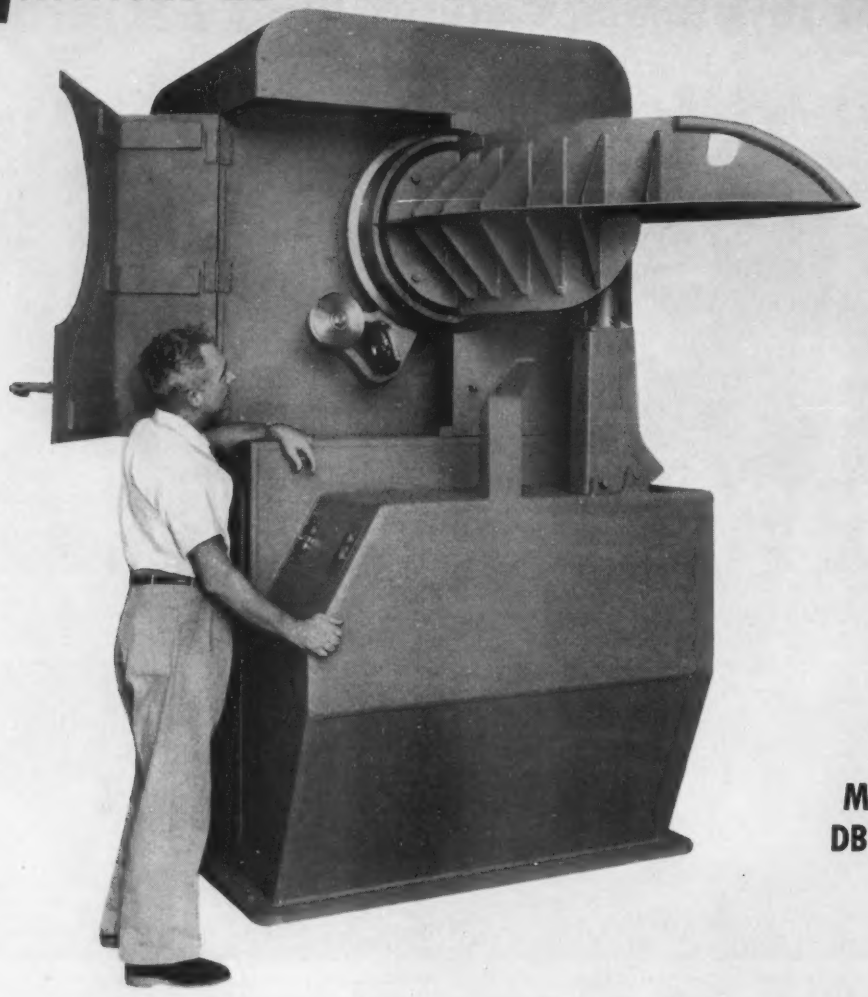


Burner assembly for zinc furnace.



Burner assembly for lead furnace.

WHITACRE 22″ WIRE DRAWING DEAD BLOCK



Model DB-22A

Continuous Production—Efficiency Approaching 100%

Gives you these advantages

Continuous increased production achieved by: • No down time for stripping • Permits packaging into stationary container or uninterrupted palletizing on stems • No tangling nor snarling from handling • Design simplicity. No back-gearing nor similar mechanisms • Greatly reduced floor space requirements • Dies in supplying drawing machine can be changed without stopping dead block • Accumulation type machines can be "run down" without stopping dead block • Continuous inspection and sampling • Breaks welded in production — low scrap loss • Increased production with lessened operator fatigue • Maintenance eliminated except for occasional lubrication of four main bearings and two motor bearings • Dead block can be located anywhere with wire literally piped from wire drawing machine • Extra large packages for in-process wire • Greatly reduced handling and in-plant transportation costs • Low capital investment.

OTHER MODELS AVAILABLE

16″ Wire Drawing Dead Block, Model DB-16A • 26″ Wire Drawing Dead Block, Model DB-26A • Combination 16″ and 22″ Galvanizing or Tinning Dead Block Take-ups, Model GB-2216A • 26″ Heavy Wire Galvanizing or Tinning Dead Block Take-up, Model GB-26B.

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WHITACRE

KEYSTONE XL WIRE STUDY

SOLVED

Cost and Production problems by KEYSTONE XL Wire at Specialty Screw CORP.

ROCKFORD, ILLINOIS

flowability IS THE SECRET

Illustrated here are parts that were formerly expensive or difficult to manufacture. Specialty Screw Corp., Rockford, Illinois, solved these problems by switching to Keystone "XL" Wire for superior cold heading.

Read these case studies thoughtfully – see if you, like Specialty Screw, can solve difficult forming operations with "XL" Wire.

Of course, we at Keystone know that it takes much more than the finest quality wire to keep a satisfied customer. So we strive to give you the best in service – in meeting and keeping deadlines and delivery dates – in working with our customers to develop the wire exactly suited to their needs. Let us do the same for you! Call your nearby Keystone representative for complete details.

Keystone Steel & Wire Company, Peoria 7, Ill.

KEYSTONE
WIRE FOR INDUSTRY

SOLVED

high cost of manufacturing valve assembly

Formerly this part was produced on a screw machine, taking 6 operations. Now, with Keystone "XL" Wire, the part is cold headed in two blows, then shaved and threaded – 4 operations. The net result is a savings of 65% in time and material.

SOLVED

quality control on rubber vibration mount

Before "XL" was used, heads cracked and there was considerable spoilage. Now, with "XL", this part is cold headed with virtually no rejects. The head is four times the diameter of the wire.

SOLVED

die cleaning problems

In order to get square shoulders on the parts shown here, the wire can't be gummy – it must have a good, dry coating. Otherwise, the dies must be cleaned frequently. "XL" solves the problem, and saves time and money!

Keystone Steel & Wire Company
Peoria 7, Illinois

COLD HEADING FACTS FOLDER . . . send coupon today! Folder discusses uses, applications, methods, technical facts, wire requirements.

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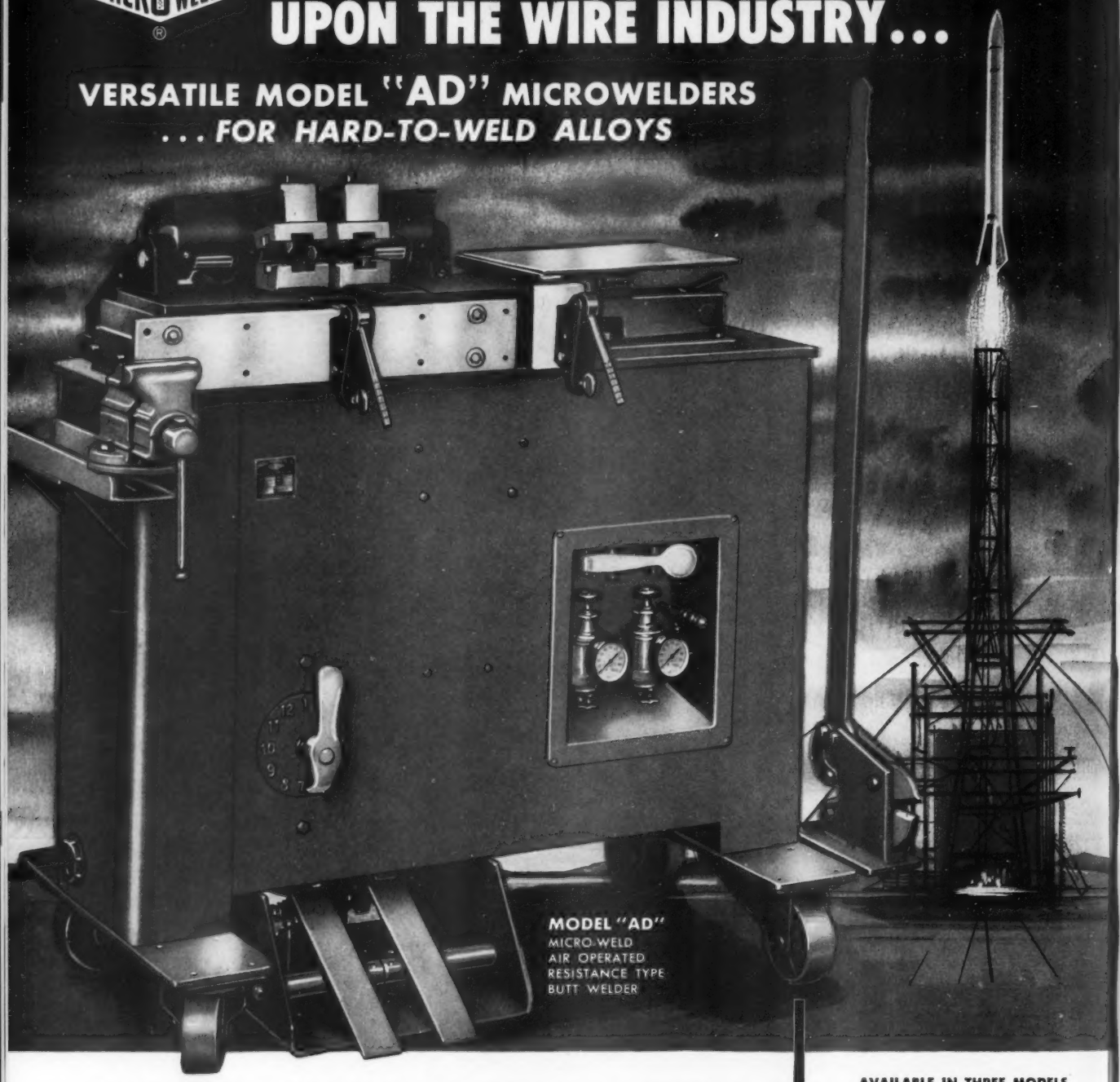
DESIGNED TO MEET NEW DEMANDS UPON THE WIRE INDUSTRY...

VERSATILE MODEL "AD" MICROWELDERS
... FOR HARD-TO-WELD ALLOYS



MODEL "AD"
MICRO-WELD
AIR OPERATED
RESISTANCE TYPE
BUTT WELDER

In this modern age of rockets and atomic projects new demands are being made daily upon the wire industry. Close and continuous contact with the wire industry has resulted in a steady flow of improvements in MICRO-WELDERS to meet specific welding requirements.

Equipped with foot operated air clamps, with adjustable air control, two stage air operated upset mechanism with high pressure finish for forge action, 12 step quick action heat tap switch, straight slide water-cooled headpieces.

AVAILABLE IN THREE MODELS

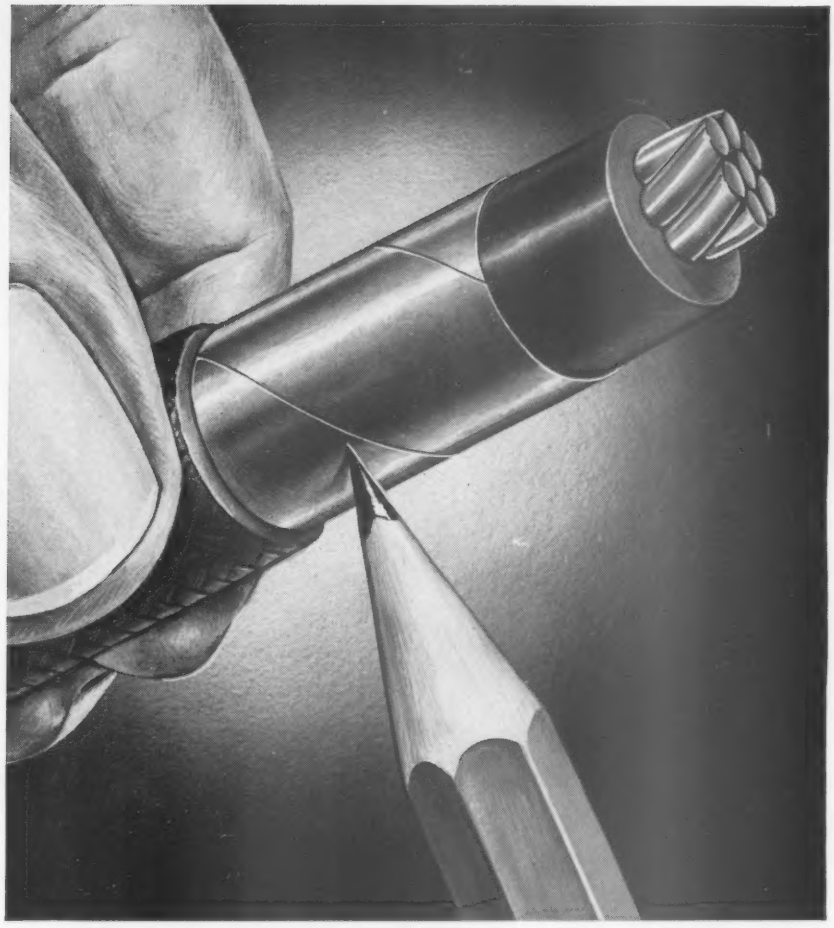
AD-3
1/4" to 1/2" diam. alum. and alum. alloy
1/4" to 3/8" diam. copper and copper alloy
1/4" to 3/8" diam. steel and steel alloy

AD-4
3/8" to 3/4" diam. alum. and alum. alloy
3/8" to 3/8" diam. copper and copper alloy
3/8" to 3/8" diam. steel and steel alloy

AD-5
1/2" to 3/4" diam. alum. and alum. alloy
1/2" to 3/4" diam. copper and copper alloy
1/2" to 3/4" diam. steel and steel alloy

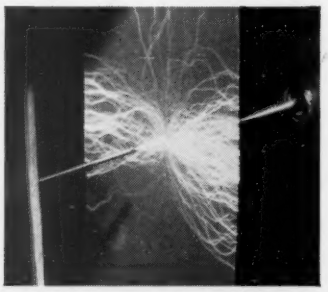
MICRO PRODUCTS CO.

20 NO. WACKER DRIVE • CHICAGO 6, ILLINOIS • TELEPHONE STate 2-7468



PROPERTIES OF "MYLAR"

"Mylar" offers a unique combination of properties that may help you improve performance and lower costs of *your* product. Here are two of the many important properties for evaluation.



HIGH DIELECTRIC STRENGTH: Average of 4,000 volts per mil . . . average power factor of 0.003 at 60 cycles.

SUPERIOR CHEMICAL RESISTANCE: Unaffected by oils, grease, most acids and alkalis, moisture and solvents.

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Tapes of Du Pont MYLAR® help improve building-wire performance . . . cut manufacturing costs

PROBLEM: National Electric Products Corp., Pittsburgh, was seeking a higher-quality material to replace rubber-filled cotton tape used in their building wire. At the same time, they were looking for ways to cut manufacturing costs.

SOLUTION: Du Pont "Mylar"* polyester film. *And "Mylar" costs less on a square foot basis than rubber-filled cotton tape.* Tests proved a tape of "Mylar" immersed in water for 12 hours absorbed less than 1% of its weight vs. 32% for rubber-filled cotton tape. Building wire using 1 mil "Mylar" had 4 times the abrasion resistance of wire using 10 mil rubber-filled cotton tape.

RESULTS: Reduced wire diameter and weight. In manufacturing, "Mylar" permits additional savings because reduced cable diameter requires less braided outer covering material. The physical toughness of "Mylar" gives extra safety against damage by flexing, pinching, bending and abrasion. Resistance to moisture and normal atmospheric oxidation is improved.

HOW CAN "MYLAR" HELP YOU? Whether you use heavy duty cable, motors, transformers or miniaturized capacitors, it will pay you to investigate the performance benefits of "Mylar". Component makers find this tough, thin film often costs less on an area basis than present insulation. For detailed information, send in the coupon.

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BETTER THINGS FOR BETTER LIVING
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POLYESTER FILM

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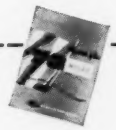

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Please send booklet listing properties, applications and types of "Mylar" polyester film available (MB-11).

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J&L extra clean, smooth, bright wire in .306" diameter is used in this sturdy motor mount by E. H. Titchener & Company.

"Wire enhances motor mount appearance, dissipates noise"

... states wire products manufacturer

"The J&L wire we use in this motor mount for a large air conditioner has a bright, clean and smooth finish so necessary for high quality plating work.

"It also meets our rigid physical and welding quality specifications," reports Mr. Paul Titchener, president of E. H. Titchener & Company, Binghamton, New York, manufacturers of quality wire goods since 1886.

"This modern mount design takes advantage of the natural resiliency of wire construction. The mount weighs only 13 pounds, provides free flow of air, minimizes vibrations," according to Mr. Titchener.

J&L manufacturer's wire has a superior quality due to close control in every phase of production from ore mine to finished product.

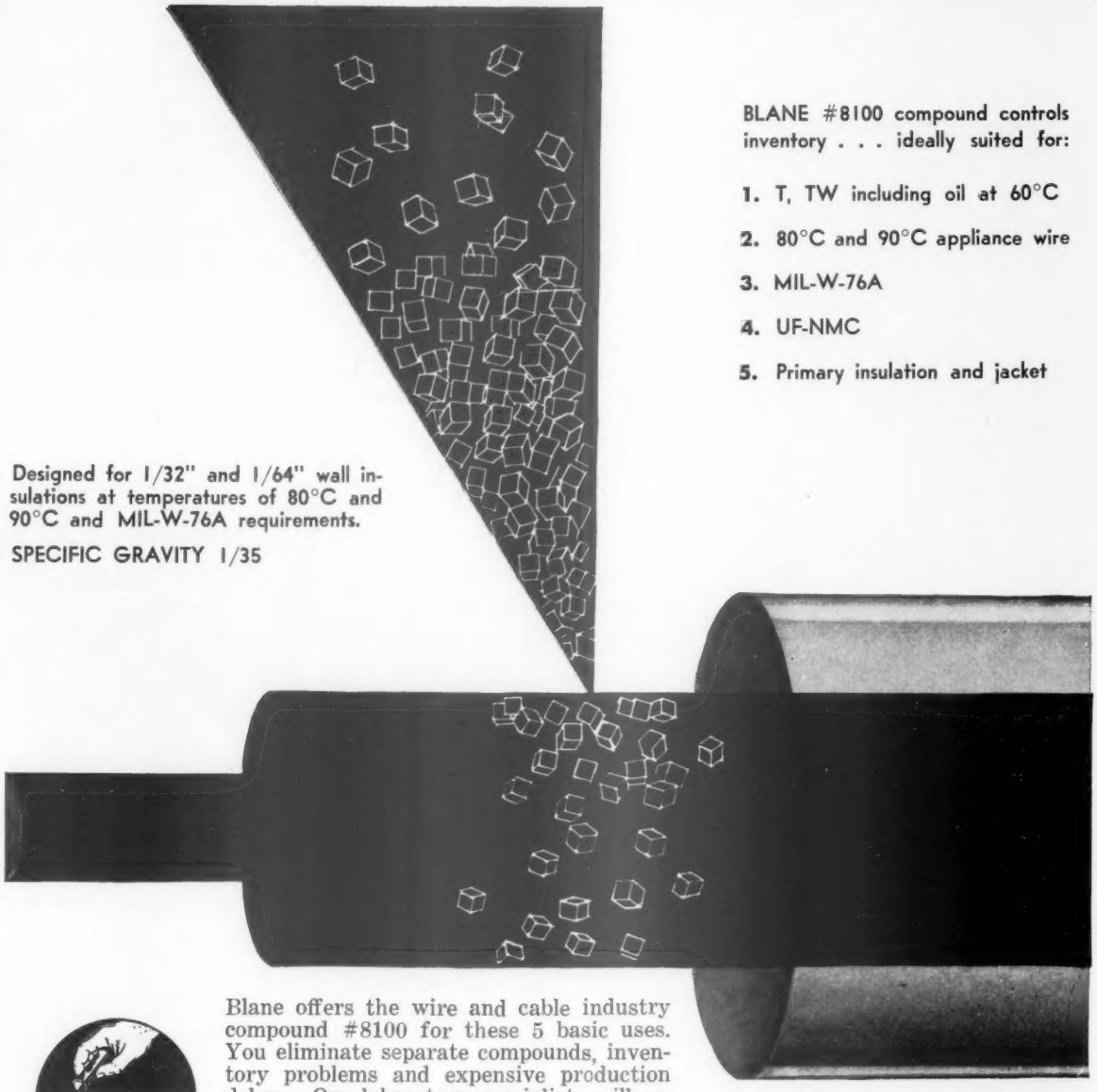
Next time you order wire, call your J&L representative for a recommendation on the exact steel wire for your specific job. Or write direct to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J&L STEEL

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

NEW BLANE COMPOUND #8100 GIVES YOU VERSATILITY PLUS LOWEST POUND VOLUME COST



BLANE #8100 compound controls inventory . . . ideally suited for:

1. T, TW including oil at 60°C
2. 80°C and 90°C appliance wire
3. MIL-W-76A
4. UF-NMC
5. Primary insulation and jacket

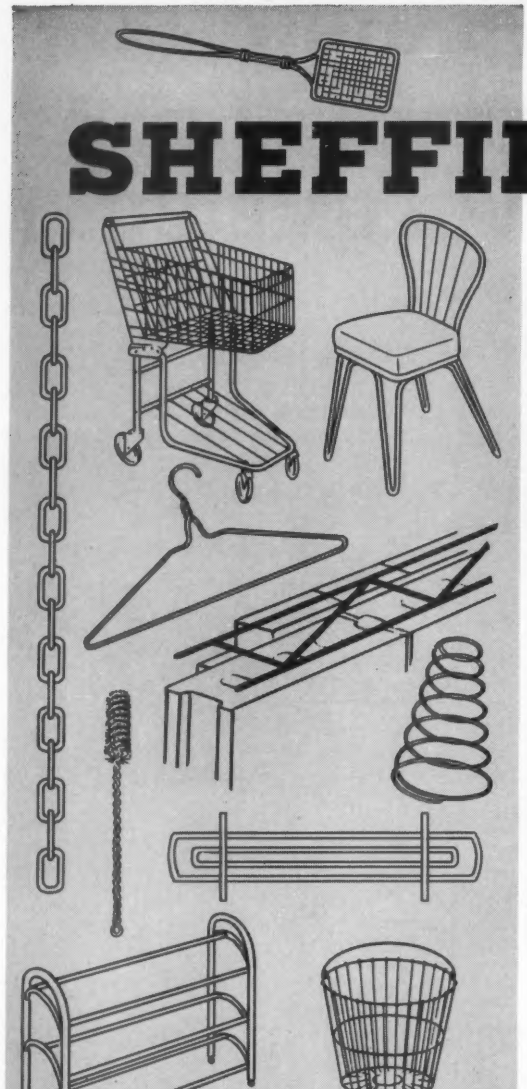
- Designed for 1/32" and 1/64" wall insulations at temperatures of 80°C and 90°C and MIL-W-76A requirements.
- SPECIFIC GRAVITY 1/35

BLANE

Blane offers the wire and cable industry compound #8100 for these 5 basic uses. You eliminate separate compounds, inventory problems and expensive production delays. Our laboratory specialists will assist you on any type of insulation problem and will develop compounds to your exact specifications. Write for samples and technical data, today!

THE BLANE CORPORATION

38 PEQUIT STREET • CANTON, MASS.



Why manufacturers use

SHEFFIELD WIRE

in more than 2,000 quality products

Manufacturers and fabricators depend on Sheffield Wire for unvarying quality and accuracy in meeting their wire specifications. They are sure of getting the RIGHT wire—and getting it fast—because of Sheffield's advanced quality controls and strategic plant locations.

We're old hands at helping customers solve wire problems—with results that speed production, cut costs and improve products.

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SHEFFIELD KONE PAK*

gives you in one continuous spool the equivalent of 2 to 40 ordinary coils of wire. It gives longer continuous runs, less down time, and can cut scrap losses as much as 90%. The Kone Pak is mounted on a disposable wooden pallet, and can be packed in streamlined cardboard container if desired.

SHEFFIELD
ARMCO® WIRE PRODUCTS

Coiled Wire

Annealed—#20 (.035" ga.) through 1"

Galvanized—#20 (.035" ga.) through #4 (.225" ga.)

Bright—#20 (.035" ga.) through 1"

Straightened and Cut Wire

Annealed—#20 (.035" ga.) through ¾"

Galvanized—#20 (.035" ga.) through #4 (.225" ga.)

Bright—#16 (.0625" ga.) through ¾"

* Patent Pending

New ALUMINIZED WIRE
16 ga. (.0625") through 6 ga. (.192")
WRITE FOR FREE SAMPLE

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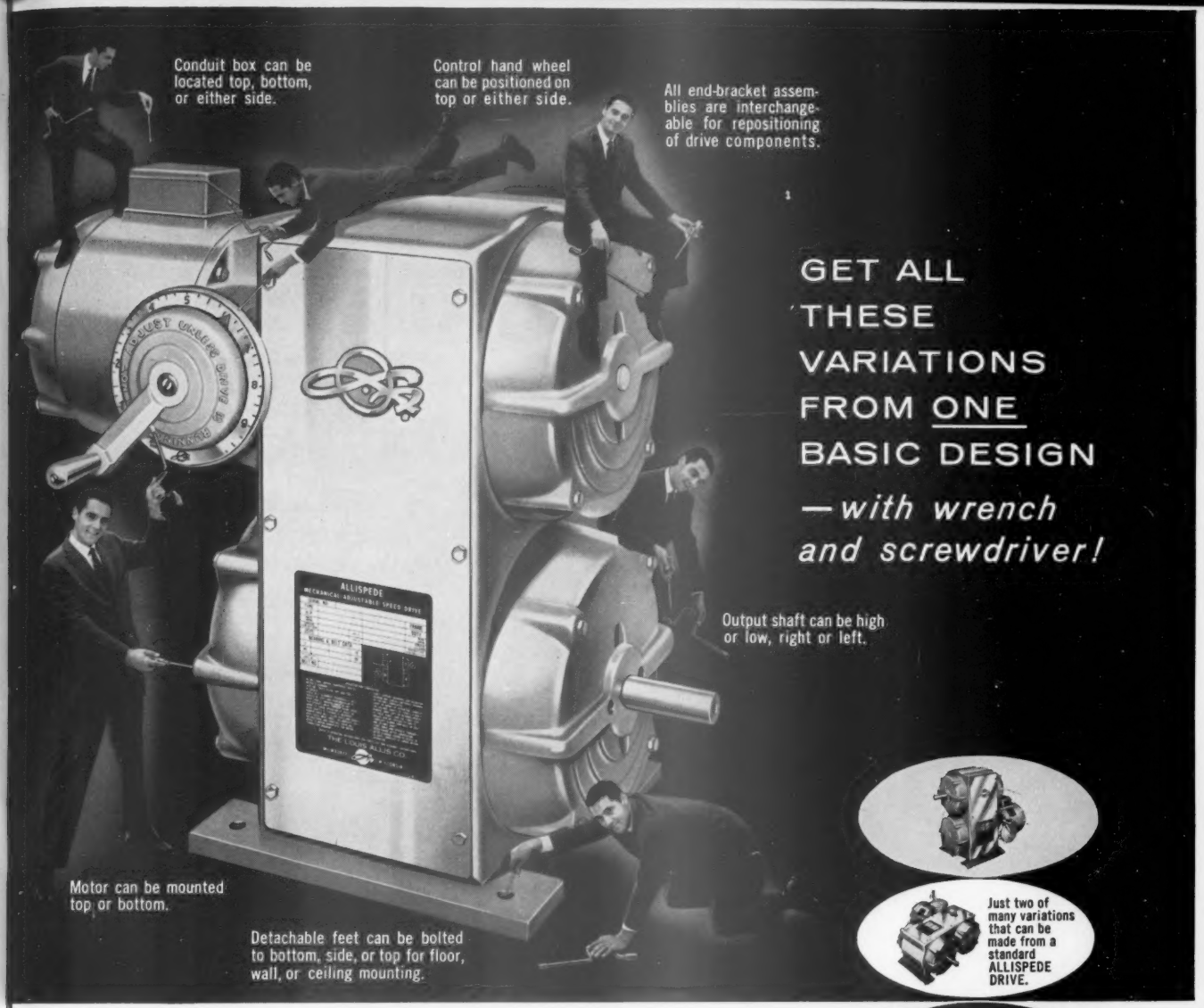
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA


Conduit box can be located top, bottom, or either side.
Control hand wheel can be positioned on top or either side.
All end-bracket assemblies are interchangeable for repositioning of drive components.
GET ALL THESE VARIATIONS FROM ONE BASIC DESIGN
— with wrench and screwdriver!
Output shaft can be high or low, right or left.
Motor can be mounted top or bottom.
Detachable feet can be bolted to bottom, side, or top for floor, wall, or ceiling mounting.
Just two of many variations that can be made from a standard ALLISPEDE DRIVE.

The ALLISPEDE* DRIVE gives you complete field versatility!

It's the most flexible and precise mechanical adjustable speed drive made . . . and the only one that can be fully adapted in the field!

The *all-new* ALLISPEDE DRIVE is the answer to any motor application that calls for low-cost adjustable speed. It permits smooth, easy speed adjustment — and maintains it exactly. Its modern design permits unusual field-flexibility — lets the user change the unit *any time* to suit his various requirements.

The a-c ALLISPEDE DRIVE is the *only* drive that can be fully adapted in the field by the user. The basic unit goes together like building-blocks . . . feet, end brackets, control hand wheel, conduit box, and output shaft can be relocated in minutes to fit existing space limitations. The same unit can be changed from an upright to a horizontal drive for floor, wall or ceiling mounting. And all you need is a wrench and screwdriver!

Superior design improves drive efficiency and extends service life. The four bearings equally distribute belt load, increasing bearing and belt life. Movable discs slide smoothly on internally-lubricated splined shafts — won't stick in place or wear. Belt changes are faster — never disturb the dial or adjustment mechanism. Rugged cast-iron housing with plated steel covers shields drive against dirt and corrosion . . . integral rotor fan cools the motor and force-ventilates the drive housing to extend bearing life. Oversize cartridge bearings are pressed on shaft and lubricated at the factory. Corrosion-resistant stainless steel nameplates diagram proper motor connection, specify bearing sizes, and carry complete instructions for operation and lubrication.

The ALLISPEDE DRIVE can be supplied with in-line or right-angle integral gears, brake and tachometer. Sizes from 1 to 20 HP with speed variations up to 8:1. Electrical and mechanical modifications are available to meet special requirements for any application.

Contact your Louis Allis District Office or Distributor for complete information and engineering assistance. Or write for Bulletin 3300, The Louis Allis Co., 451 E. Stewart Street, Milwaukee 1, Wisconsin.

*ALLISPEDE is a trademark of The Louis Allis Co.

ASD-118

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

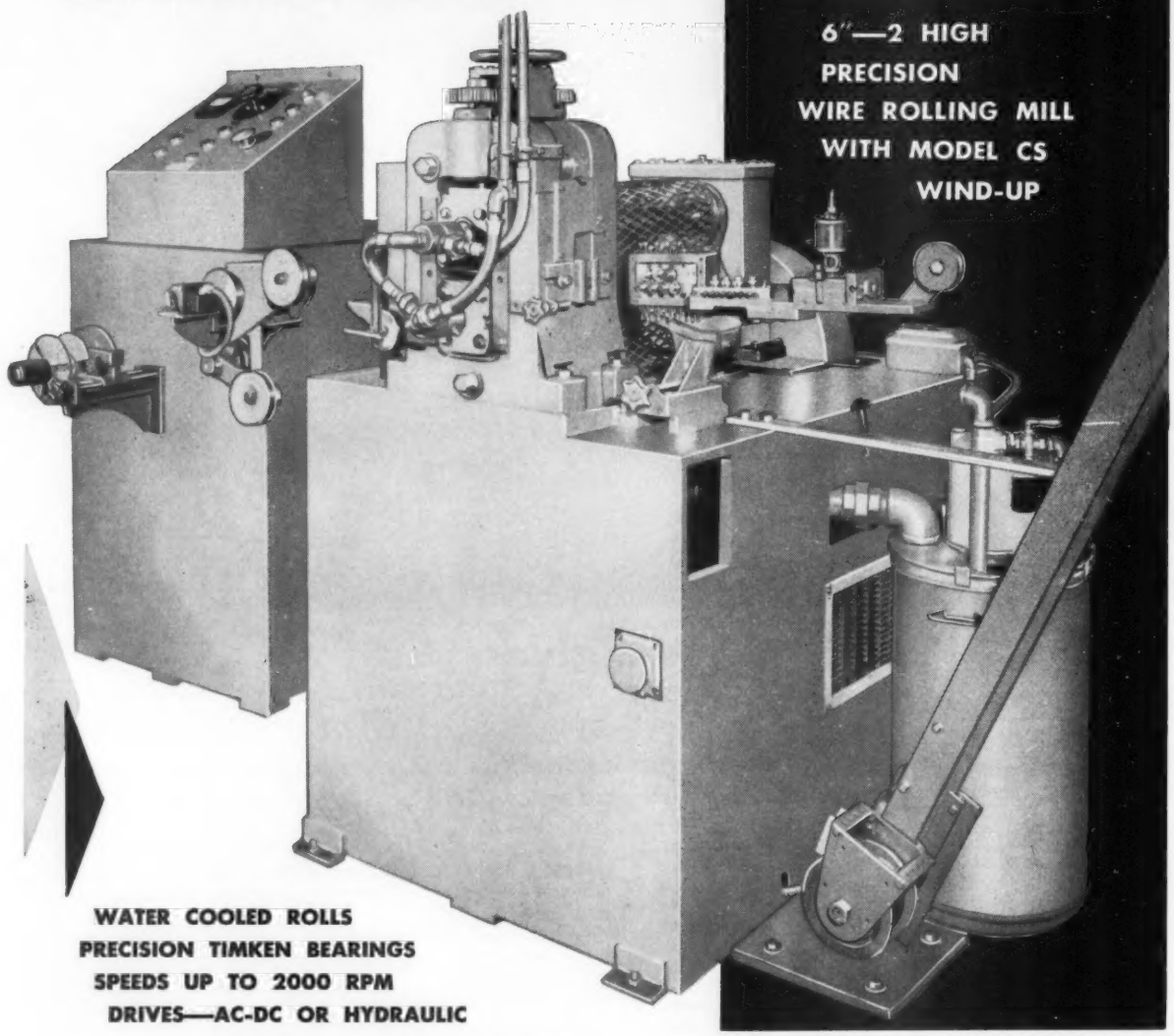
wire ENGINEERED

Wire Flattening Unit

For Ferrous and Non-Ferrous Metals

MODEL 62

6"—2 HIGH
PRECISION
WIRE ROLLING MILL
WITH MODEL CS
WIND-UP



WATER COOLED ROLLS
PRECISION TIMKEN BEARINGS
SPEEDS UP TO 2000 RPM
DRIVES—AC-DC OR HYDRAULIC

WIND-UP RANGE—2" x 5" DIAM. UP TO 4" x 6" DIAM.

wire ENGINEERING ASSOCIATES, INC.

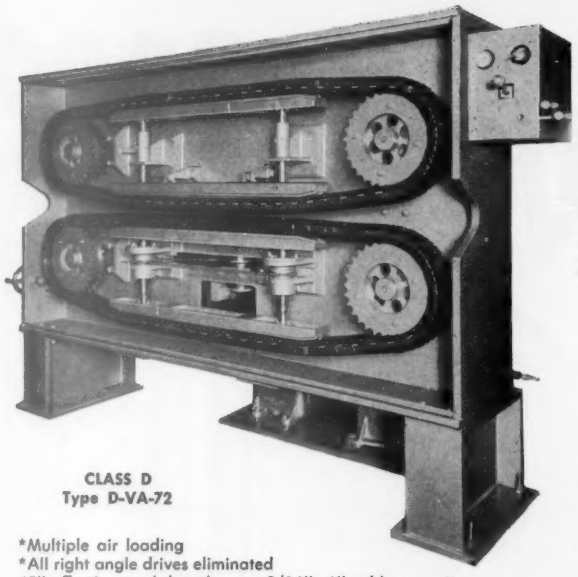
16130 VAN DRUNEN ROAD • SOUTH HOLLAND, ILLINOIS

Midwest Representative: Bronson & Bratton Inc., Chicago 32, Illinois

*High-Efficiency** CATERPULLERS

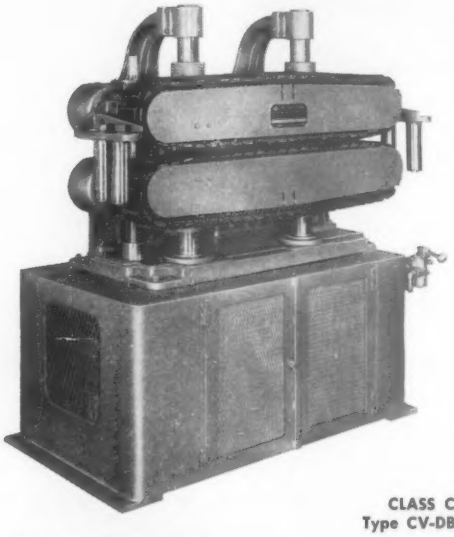
With a complete range of speeds, pulls and capacities.
Choice of horizontal and vertical types.

NEW EFFICIENCIES
Improved drive • Air-Loaded Heads
Non-destructive, controlled gripping
Anti-friction tracks
Greater pulls at lower H.P. input



CLASS D
Type D-VA-72

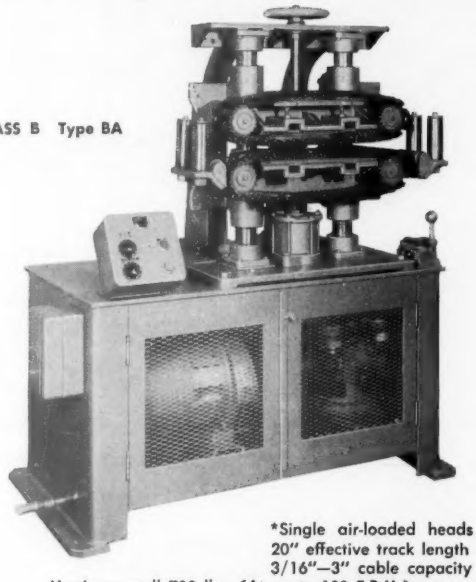
*Multiple air loading
*All right angle drives eliminated
45" effective track length • 3/16"—6" cable capacity
Maximum pull 4000 lbs. (At up to 90 F.P.M.)
650 F.P.M. maximum recommended operating speed
Floating track design • For inputs up to 15 H.P. maximum



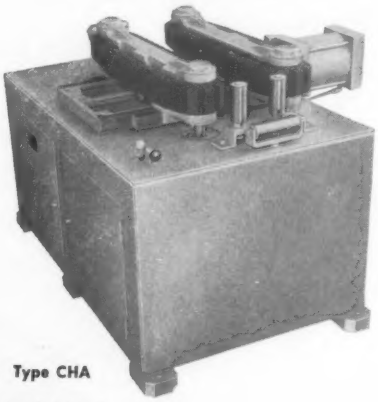
CLASS C
Type CV-DB-40

*Double air-loaded heads
30" effective track length • 3/16"—6" cable capacity
Maximum pull 6000 lbs. (At up to 65 F.P.M.)
500 F.P.M. maximum recommended operating speed
For inputs up to 20 H.P. maximum

CLASS B Type BA



*Single air-loaded heads
20" effective track length
3/16"—3" cable capacity
Maximum pull 700 lbs. (At up to 100 F.P.M.)
500 F.P.M. maximum recommended operating speed
For inputs up to 3 H.P. maximum



CLASS C Type CHA

*Single air-loaded head
Horizontal tread arrangement
30" effective track length • 3/16"—6" cable capacity
Maximum pull 6000 lbs. (At up to 60 F.P.M.)
For inputs up to 15 H.P. maximum

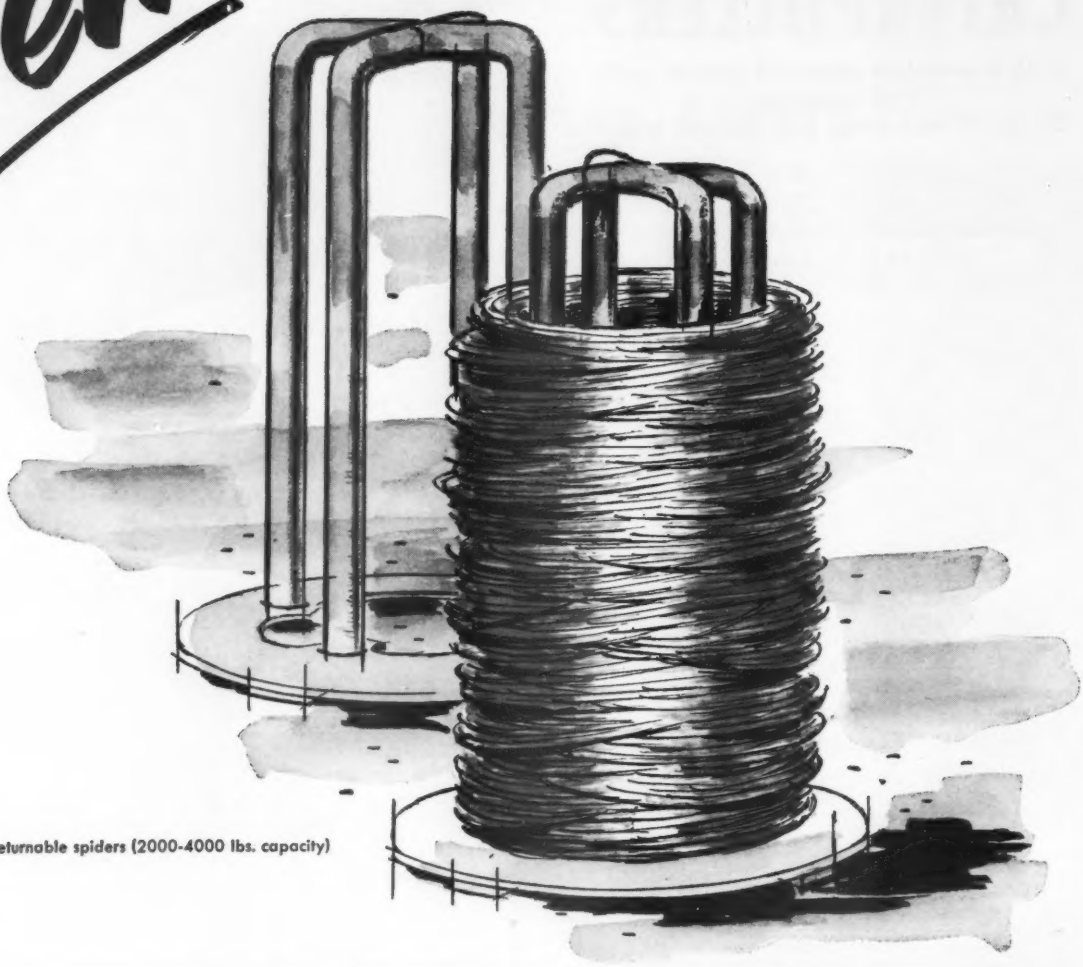
GENERAL INFORMATION

All units are available with readily interchangeable treads with a choice of durometers. Treads can be contoured to match cable diameter to minimize unit pressure. Units are available with or without drives.

ENTWISTLE
Manufacturing Corporation

1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND

New 3000-4000 lb.



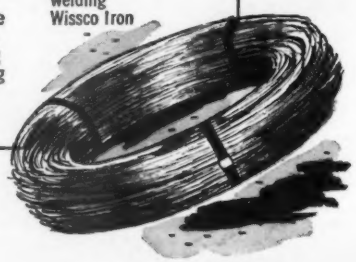
Returnable spiders (2000-4000 lbs. capacity)

Here is a partial list of the many types of carbon steel wire manufactured by CF&I:

Grades	Finishes
low carbon	bright dry drawn or lime bright
annealed flat and shaped	bright grease drawn
medium high carbon	cadmium coated
	coppered
high carbon	extra clean
flat and shaped	smooth bright
oil tempered	galvanized
spheroidized	liquor
	white liquor

Standard Types (partial list)

aircraft cord	fuse	merchant	square
bee	Gamma spring	nail	stapling
bobbin ring	garment hanger	oil tempered	staple
bobby pin	glass netting	picker tooth	stone
bookbinder	hair pin	picture cord	tie
broom	hat	pin ticket	twisted & laid
brush	hose, reinforcement	regulator	upholstery
casing	hose, mechanical	rope	valve spring
clip	hose, vacuum	safety pin	weaving
concrete reinforcing tie	lock spring	screen	welding
cotter pin	lockwasher	shaft, flexible	Wissco Iron
curtain spring	manufacturers' drawn	Signal Corps	
die spring	mattress	snake fishing	
fine & weaving		spiral binding spring	



Steel strapped coils (200-2000 lbs.)

WHEN YOU NEED WIRE . . . MAKE

CONTINUOUS WIRE "SPIDER"

. . . cuts downtime as much as 15%

. . . reduces scrap loss

Here's what CF&I's new giant package did for one upholstery spring manufacturer who had been using 700-lb. wire coils:

- **Downtime was reduced**
- **Production was increased 15% per shift**
- **Men and materials handling equipment were freed for other work**
- **Scrap losses were reduced**

These returnable spiders will cut your production costs, too. If your manufacturing process is not equipped to use spiders, order our 200-2000 lb. continuous-length, steel-strapped wire coils. (Sizes #13 AWG and coarser apply for both spiders and coils.)

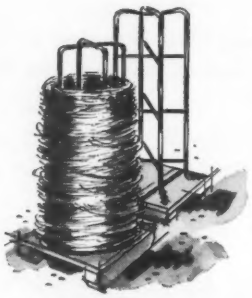
From spools to spiders . . . CF&I's newly modernized and enlarged plants are equipped to provide fast delivery on high or low carbon steel wire . . . round, flat or shaped . . . in a wide variety of sizes, tempers, grades and finishes . . . in small quantities or carload lots. Let us know your requirements.

CF&I-WICKWIRE WIRE

THE COLORADO FUEL AND IRON CORPORATION

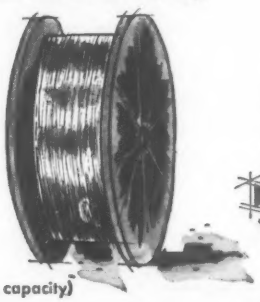
THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver El Paso • Ft. Worth • Houston • Kansas City • Lincoln (Neb.) • Oklahoma City • Phoenix • Pueblo • Salt Lake City • Wichita
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • San Leandro • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York Philadelphia • **CF&I OFFICES IN CANADA:** Montreal • Toronto • **CANADIAN REPRESENTATIVES AT:** Calgary Edmonton • Vancouver • Winnipeg

Other CF&I standard packaging methods

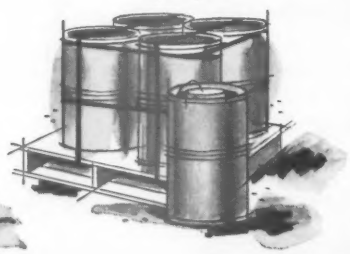


Non-returnable spiders (500-700 lbs. capacity)

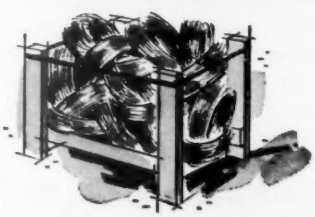
Reels (500-800 lbs. capacity)



Pay-off paks



Steel strapped wooden rack

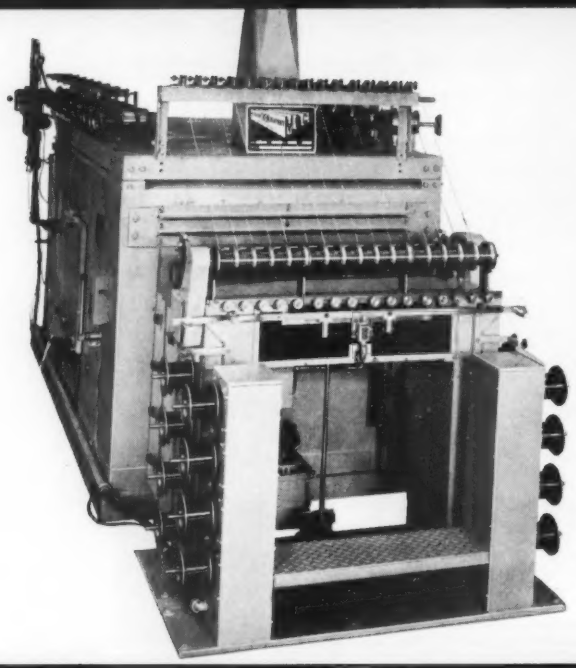


5758

CF&I YOUR SOURCE OF SUPPLY

EXPERIENCE:

Twelve years of development in gas-fired equipment— Three years of "on-the-job" production results



WIRE ENAMELING MACHINES

Typical of the complete line is this type "B" machine which handles wire from 31 A.W.G. to 42 A.W.G.

Five other models complete the range from the finest through large rectangles. The horizontal, high volumetric, recirculating double-pass oven allows greatly increased production by rapid heat impartation and a high degree of temperature uniformity throughout the wire chamber. Other features include: a catalyst within the recirculating stream consumes solvents and releases heat energy, individual clutches in each head of the wire capstan, automatic braking device controlling wire tension.

CONTINUOUS BRIGHT ANNEALERS

This is the first direct gas-fired annealer using the heating equipment as an internal inert atmosphere generator. Advanced mixing and burning equipments are utilized which exclude the need for external sources of steam or costly inert atmospheres. They are available in horizontal or vertical mounting positions. MOCO Annealers are of the high volumetric recirculating type with automatic air-fuel gas ration maintained over the entire range. They have a water sealed exit. No external source of inert atmosphere is needed.

WIRE ENAMELING DIVISION

MICHIGAN OVEN COMPANY

425 Brainard • Detroit 1, Michigan

Naugatuck PARACRIL OZO

The oil-resistant, ozone-resistant nitrile rubber

Now! lasting **COLORS** in rubber wire jackets

A development of Naugatuck research makes it possible to combine in a vulcanized rubber wire jacket all these properties:

- Excellent resistance to ozone and outdoor "weathering"
- Outstanding heat resistance
- High abrasion resistance
- Excellent oil, grease and chemical resistance
- Fast CV extrusion

...PLUS PERMANENT BRIGHT COLORS

In addition to the suggested uses, you will think of dozens of other applications where wire jacketing with all these properties can serve either an aesthetic or utilitarian purpose.

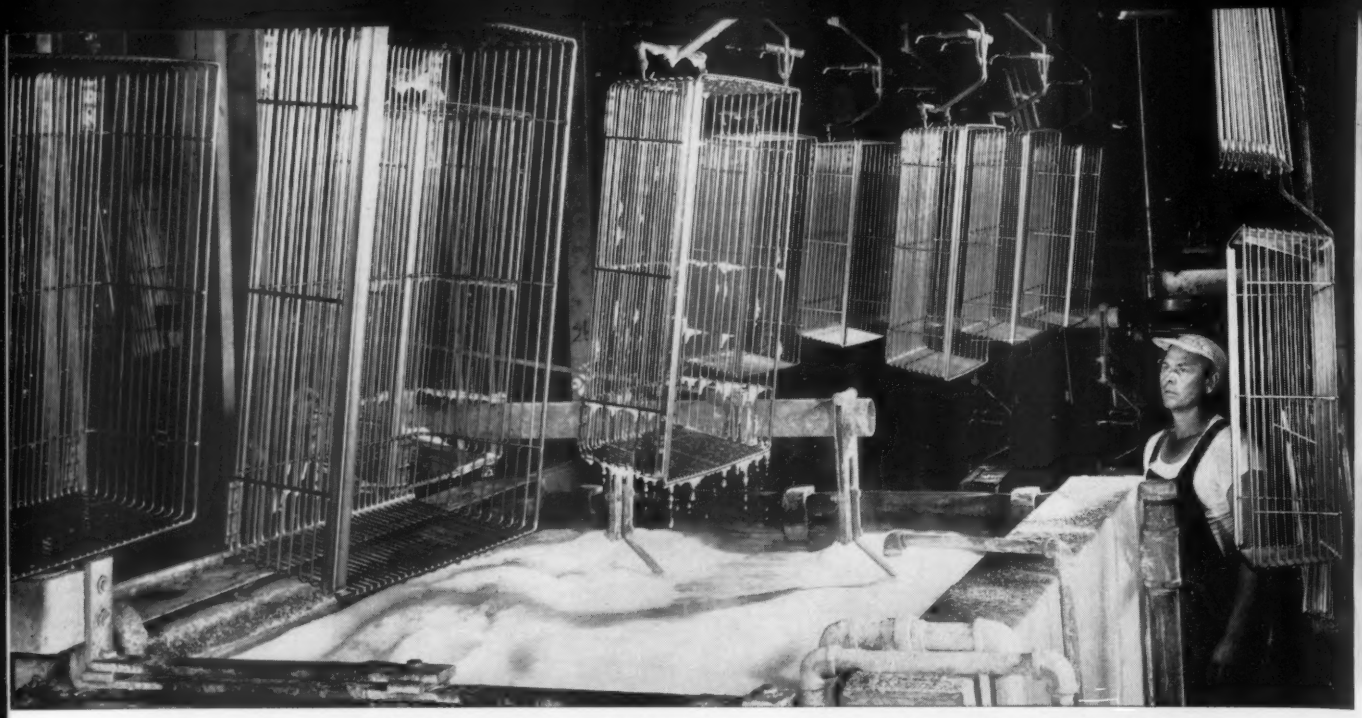
One of Naugatuck's technical representatives will be happy to discuss with any prospective user the formulation of the Paracril® Ozo compound which makes possible this combination of properties... not only in wire jacketing but also in shoe soles, hose jackets, weather stripping and other vulcanized rubber products.

Naugatuck Chemical

Division of United States Rubber Company

1141-P Elm Street
Naugatuck, Connecticut

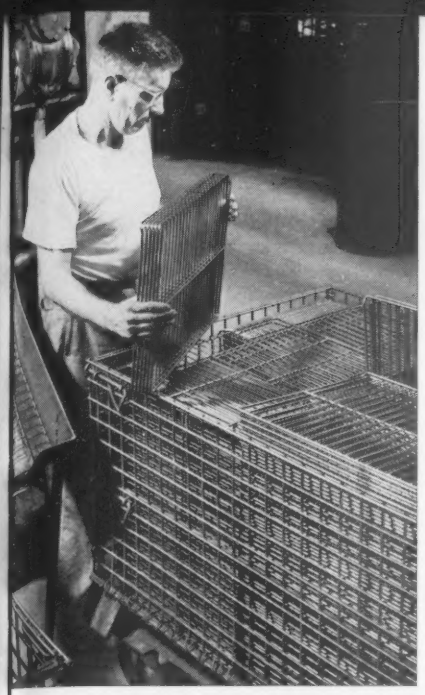
Rubber Chemicals · Synthetic Rubber · Plastics · Agricultural Chemicals · Reclaimed Rubber · Latices · CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario · CABLE: Rubexport, N.Y.



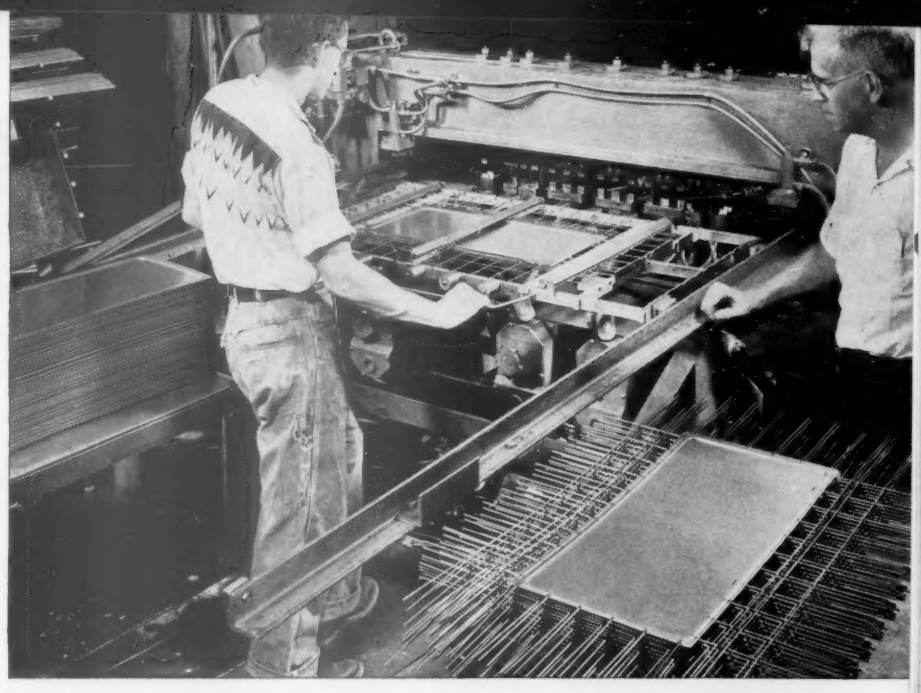
Baskets for a combination refrigerator-freezer enter plating line on conveyor. They are shown here leaving the first bath, an alkaline cleaner, and moving to a clear water rinse. A total of 15 immersions are given these baskets in the process of plating them with a .0005 inch coating of zinc. Below: The excellent surface required for plating is shown in the Pittsburgh Steel wire stockpiled at Bauer Bros. Co. in its Springfield, Ohio, wire division.

Bauer Bros. Gets Extra Clean Wire For Fully Automated Plating Lines

Defect-free Finish of Pittsburgh Steel Co. Wire Eliminates Costly Surface Preparation



This machine was designed and built by Bauer Bros. own personnel to speed the efficient production of racks, seen here coming off the end of the unit.



On this automatic multi-welder, design-specified by William Cannell, right, Bauer Bros. Co. master mechanic, a total of 288 different combinations of welds can be made. Here the operator is welding wire to a solid bottom basket for use by a major appliance manufacturer.

Bauer Bros. Co. demands, and gets, from Pittsburgh Steel Company extra smooth, clean, bright wire which can go into plating lines without any expensive surface preparation.

This is only possible with wire that has an extremely clean, defect-free surface.

Bauer Bros. Co. keeps its Springfield, Ohio, plant's automated plating line running smoothly with consistently excellent results.

The Wire Division of Bauer Bros. Co. fabricates wire shelves, racks and baskets for refrigerators, freezers, ovens and other appliances made by virtually every major appliance manufacturer.

Bauer Bros. buys coils of wire which it cuts into proper lengths, straightens and then forms into finished products on automatic shaping and welding machines, many of which were designed by Bauer Bros. personnel.

On these machines, Pittsburgh Steel's bright basic wire gets its first test. Good grain structure gives the wire ability to take severe bending without ripping or tearing. Uniform hardness from coil to coil and from shipment to shipment speeds production and holds down rejects.

• **Meets Customer's Demands**—On a completely automated plating line, Pittsburgh Steel wire meets Bauer Bros. demands for freedom from pits, seams and porosity.

So, Pittsburgh Steel wire helps Bauer Bros. Co. two ways:

1. More economical production on automatic machines and on plating lines.

2. Improved appearance of the final product adds to salability.

Bauer Bros. Co. can plate its wire products with any of these coatings:

A combination of copper, nickel and chrome; zinc, clear or colored lacquer, and plastic (the new Corvel Fusion Bond process).

Products come to the plating line on an overhead conveyor directly from the Fabrication Department. Without any stops, the conveyor immerses products in a series of tanks on the plating line. In zinc plating, pictured here, baskets are dipped in a total of 15 tanks without a halt and without the intervention of a human hand. Drying and baking complete the plating cycle.

On these baskets, destined for use in a new combination refrigerator-freezer made by one of the country's largest appliance manufacturers, the zinc coating never falls below .0005 inch.

After plating, coatings are laboratory checked for porosity, density and resistance to wear and corrosion. In one test, products are enclosed in a salt air immersion chamber where temperature is maintained at 100 degrees F. and humidity at a sweltering 100 percent. A five percent salt solution gives the zinc a rugged workout.

Standards like these, rigidly maintained, call for the best in wire. The wire must be the ultimate in cleanliness, smoothness and uniformity. Pittsburgh Steel wire meets these specifications day in and day out.

Like Bauer Bros. Co., you also can get production economies and a more salable product from the use of Pittsburgh Steel's basic wire. Whatever you make from any type of manufacturers wire—from nails to precision springs—let a Pittsburgh Steel representative show you what Pittsburgh Steel quality and service can do for you. You can start benefiting today by getting in touch with the nearest district sales office.

Pittsburgh Steel Company

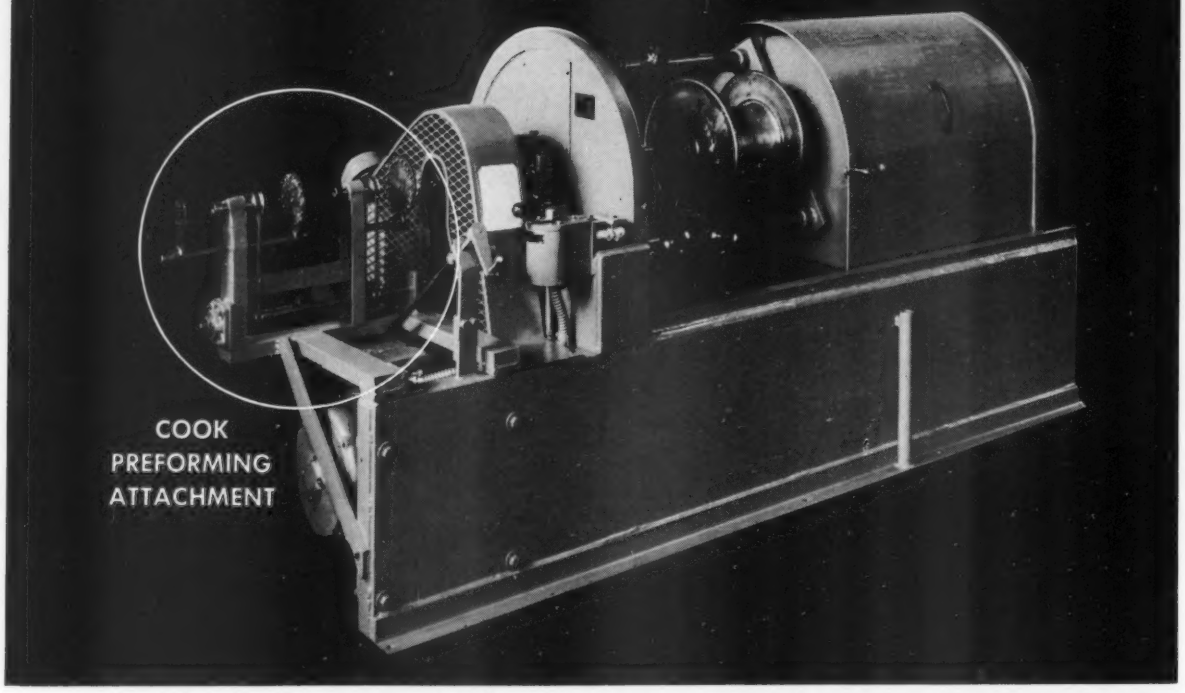
Grant Building • Pittsburgh 30, Pa.

District Sales Offices

Atlanta	Cleveland	Dayton	Los Angeles	Pittsburgh
Chicago	Dallas	Detroit	New York	Tulsa
		Houston	Philadelphia	Warren, Ohio

COOK BUNCHERS

MAKE WIRE AS CONCENTRIC AND PERFECT AS STRANDING EQUIPMENT



Cut Insulating Material and Labor Costs... Speed Production

MEET MILITARY SPECIFICATION: MIL-W-5086

CHOOSE THE CAPACITY THAT MEETS YOUR NEEDS

MODEL	REEL SIZE	CAPACITY
B-H-8	8" x 6"	45 lbs.
B-H-12	12" x 8½"	90 lbs.
B-H-16	16" x 8½"	200 lbs.
B-H-22	22" x 11"	500 lbs.
B-H-24	24" x 10½"	1000 lbs.
B-H-30	30" x 11"	1000 lbs.

CAPACITY BASED ON SOLID COPPER WIRE

For production of either concentric wire, where layers are made up of wires in opposite direction of lay, or, semi-concentric wire, where layers are made up of wires in the same direction but with different lay to prevent strand locking, you can't beat a Cook Buncher. The single twist flyer, large take-up reel, and automatic lay control are three of many features which enable Cook Bunchers to deliver perfectly bunched wires at high speed—so perfect that they pass through an extruding die of only 1 mil clearance. This perfect wire eliminates wasted time and material when insulating. Can you use this kind of dependable production? Write today for complete information.

ALSO ASK ABOUT COOK CABLERS

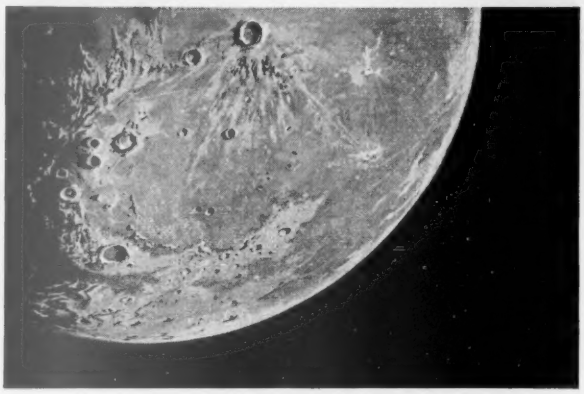
COOK MANUFACTURING CO.

50 EAST 25th STREET, PATERSON, N. J. • ARmory 4-6380

CANADIAN AGENT
E. V. LARSON CO., LTD., TORONTO, CANADA

EUROPEAN AGENT
CAPAMADJIAN LE MONNIER CIE LTD., PARIS, FRANCE

Naugatuck NAUGAPOL SPECIALLY-PROCESSED SBR POLYMERS



dry . . . . . drier . . . . . DRIEST

DRYNESS in all the above examples stems from lack of moisture in the surrounding environment. Naugapol® styrene-butadiene rubber, on the other hand, is dry—and stays dry—*in spite* of surrounding moisture!

That's because we specially process all eight types* of Naugapol polymers to eliminate moisture-absorbing salts. Acid is used in place of salt as the coagulant following polymerization, and extra straining and milling further remove water solubles. As a result these premium grades of rubber are noted for their:

- **HIGH DIELECTRIC PROPERTIES**
- **LOW ASH CONTENT**
- **EASY PROCESSING**

These properties make Naugapol polymers ideal for use in the extruding of wire and cable insulation and the manufacture of mechanical rubber goods where low moisture absorption properties are required. For more details on these and other special grades of synthetic rubber, write us about your requirements.

*Naugapols are made in types 1016, 1018, 1019, 1021, 1022, 1023, 1503 and 1504.

Naugatuck Chemical

1141 N ELM STREET

Division of United States Rubber Company, **Naugatuck, Connecticut**

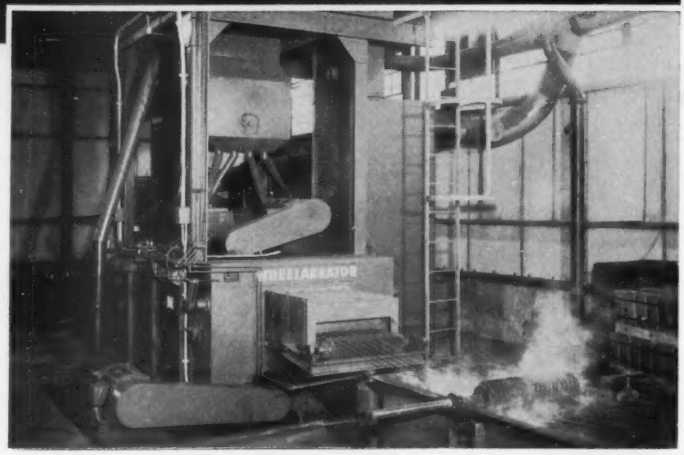
US RUBBER

Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario • CABLE: Rubexport, N.Y.

FROM HOT ROLLED ROD THROUGH PATENTING, CLEANING AND COATING IN ONE CONTINUOUS OPERATION

THE LESCHEN WIRE ROPE DIV. AUTOMATED STRAIGHT-LINE PRODUCTION METHOD

A. Twelve-strand Payoff Reels.
B. Rod Annealing Furnace.
C. Lead Quench (Patenting).
D. Water Quench.
E. Wheelabrator Abrasive Blast Descaling Cabinet.
F. Borax Coating and Drying.
G. Horizontal Takeup Recoilers.



Leading producers of wire products are now using Wheelabrator® straight-line abrasive blast descaling as the shortest distance between steel rod and wire profits. At H. K. Porter Company, Inc., Leschen Wire Rope Division, St Louis, for example, this process is resulting in exceptional production efficiency and economy.

The automated processing line starts with hot rolled rod, and in one continuous operation produces cleaned and coated rod for subsequent drawing. Wheelabrator mechanical blast descaling is an essential step in this process. It cleans twelve strands at a time in line with patenting, coating and drying and delivers cleaned and coated rod for multiple hole drawing. There is no interruption and no intermediate handling required. Furthermore, the line operates continuously five days a week, 24 hours a day without downtime.

All scale or rust is completely removed down to virgin metal, at speeds required for patenting. The fine matte finish obtained holds a more uniform coating and provides excellent drawing characteristics. This blast descaling process offers freedom from the problems associated with acid pickling. And, through automated production, important additional savings in time and labor costs are achieved by reducing "in process" inventories.

It will pay you to consider this new process for cleaning any type of ferrous or non-ferrous hot rolled rod and bar stock for cold drawn products.

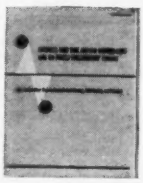
50 YEARS OF PROGRESS
WHERE PIONEERING LEADERSHIP INSURES PERFORMANCE

WHEELABRATOR
CORPORATION

389 South Byrkit Street Mishawaka, Indiana
Canadian Offices: Scarborough (Toronto) — Montreal

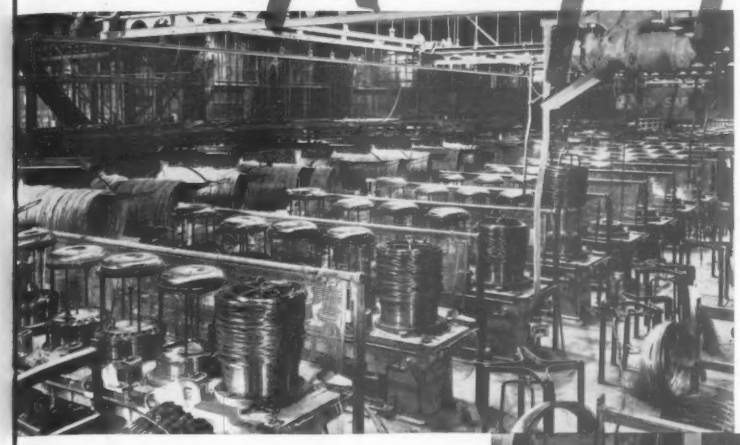
HOW TO AUTOMATE YOUR WIRE DRAWING LINE

This new booklet explains how Wheelabrator blast descaling can enable automation of your wire production. Write for Bulletin 148-D.



WORLD'S LARGEST MANUFACTURERS OF AIRLESS BLAST CLEANING EQUIPMENT AND STEEL ABRASIVES

EACH INSTALLATION *A top producer.*



Yes, the proof is in the production—and Morgan-Connor Wire Machines have an international reputation as high volume producers.

The Morgan-Connor all air-cooling method and no-slip storage principal rapidly remove heat from the wire. Exacting specifications are met at high speeds.

Sheffield Steel Division
Armco Steel Corp.
Kansas City, Missouri

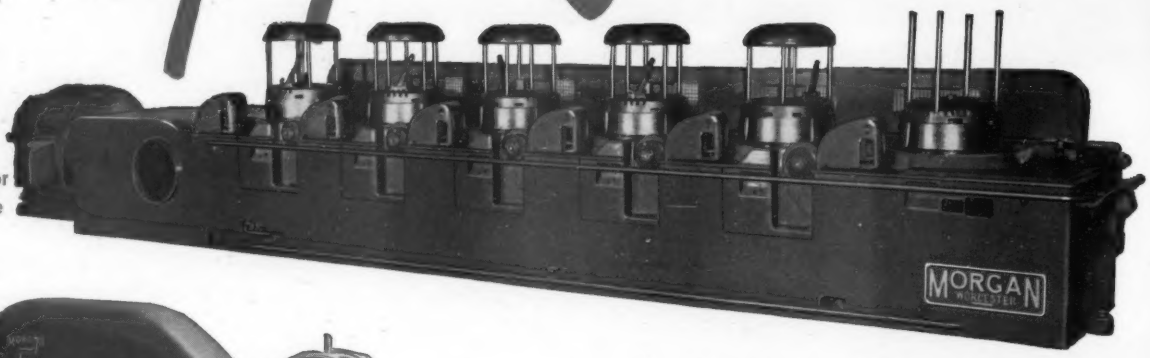
Laclede Steel Company
Alton, Illinois

Wickwire Spencer Steel Divis
Colorado Fuel and Iron Corp
Palmer, Massachusetts

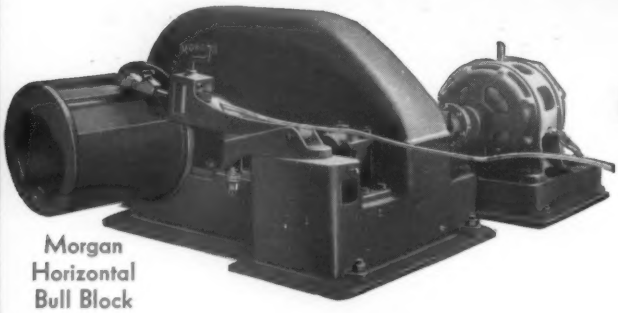
MORGAN-CONNOR
WIRE MACHINES

TU
TO
MORGA
CONN
MACHIN

EVERY MACHINE *A top performer!*

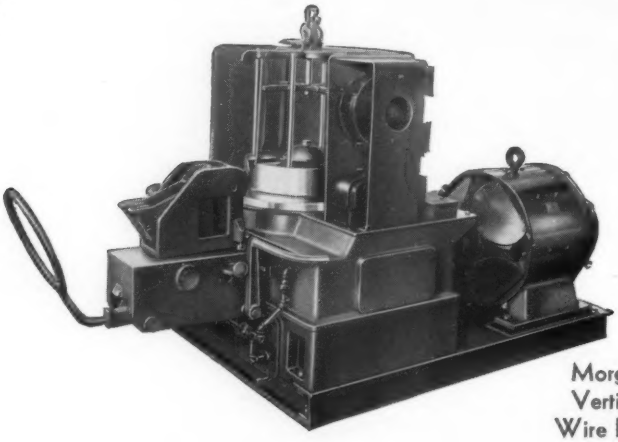


Type BW
Morgan-Connor
Wire Machine



Morgan
Horizontal
Bull Block

Economy of Floor Space



Morgan
Vertical
Wire Block

High Production

-Morgan
l Block

Long Die Life

Safety afforded the Operator

MORGAN-CONNOR
WIRE MACHINES

Morgan Construction Company WORCESTER, MASS.

ROLLING MILLS • MORGOIL BEARINGS • REGENERATIVE FURNACE CONTROL • EJECTORS • GAS PRODUCERS

FABRICATE PARTS

easier, faster, better with

UNITED WIRE

When specs are tough, requirements rigid, savings essential, fabricate your parts with United Wire . . . aluminum, brass and copper alloys including 10-12-18% nickel silver. Here are the big important things you'll find in United Wire:

- Commercially bright — reduces finishing cost after forming.
- Tolerances — drawn or shaped to your most exacting standards.
- Temper — uniform throughout, every order, every time.
- Uniform coils — for trouble free pay-off.
- Size and shape — available in most sizes and shapes — round, square, flat and half-round.

Your "Wire Forms" can be fabricated easier and better at high speed production with low or no scrap loss by using "United" round or shaped wire.

UNITED WIRE
AND SUPPLY CORPORATION

PROVIDENCE 7, RHODE ISLAND

ALUMINUM, BRASS, COPPER WIRE AND TUBE - BRAZING ALLOYS AND FLUXES

WIRE and WIRE PRODUCTS

reaches many prospects

YOUR SALESMEN DON'T KNOW!

No matter how big you are, the odds are you don't know all your actual prospective customers.

If your company is small, it is even more important to be "calling" on your prospects and customers regularly through advertising.

Your advertising in Wire and Wire Products will be seen by many people in the plants you wish to "sell", whom your salesmen never would see, yet who specify, actually buy or who influence decisions on products to be purchased. Your advertising is bound to be of immeasurable value to you, too, in paving the way for a good reception for your salesmen when they do call. And the field's buying power is tremendous!

WIRE AND WIRE PRODUCTS circulation is all paid. We have no agents, offer no premiums or make special inducements to get circulation, except the value of the editorial contents in itself—yet our renewals have averaged 97% or better for many years. That's why it is a good and forceful advertising medium for all concerns who have products to sell to this vigorous and progressive industry.

Subscribers by Types of Mills in the Industry

1. Rod, Bar and Wire (producers of rod, bar and wire in all metals and shapes)	38%
2. Forming and Fabricating Plants (mfrs., largely from purchased wire, of springs, wire cloth, bolts, nuts, screws, rivets, wire forms, fences and fencing, wire specialties, wire rope and electric wire and cable)	59%
3. Miscellaneous—Libraries, Research Organizations, Jobbers, Distributors, etc.	3%

Subscribers by Types of Positions Held

1. Executives: Presidents, Vice Presidents, Secretary-Treasurers, Purchasing Agents, Sales Managers	22%
2. Operating: Vice Presidents, General Managers, Works Managers, Superintendents and Assistant Superintendents	58%
3. Research and Maintenance: Plant Engineers, Metallurgists, Laboratory Technicians, Foremen and Inspectors	19%
4. Libraries	1%

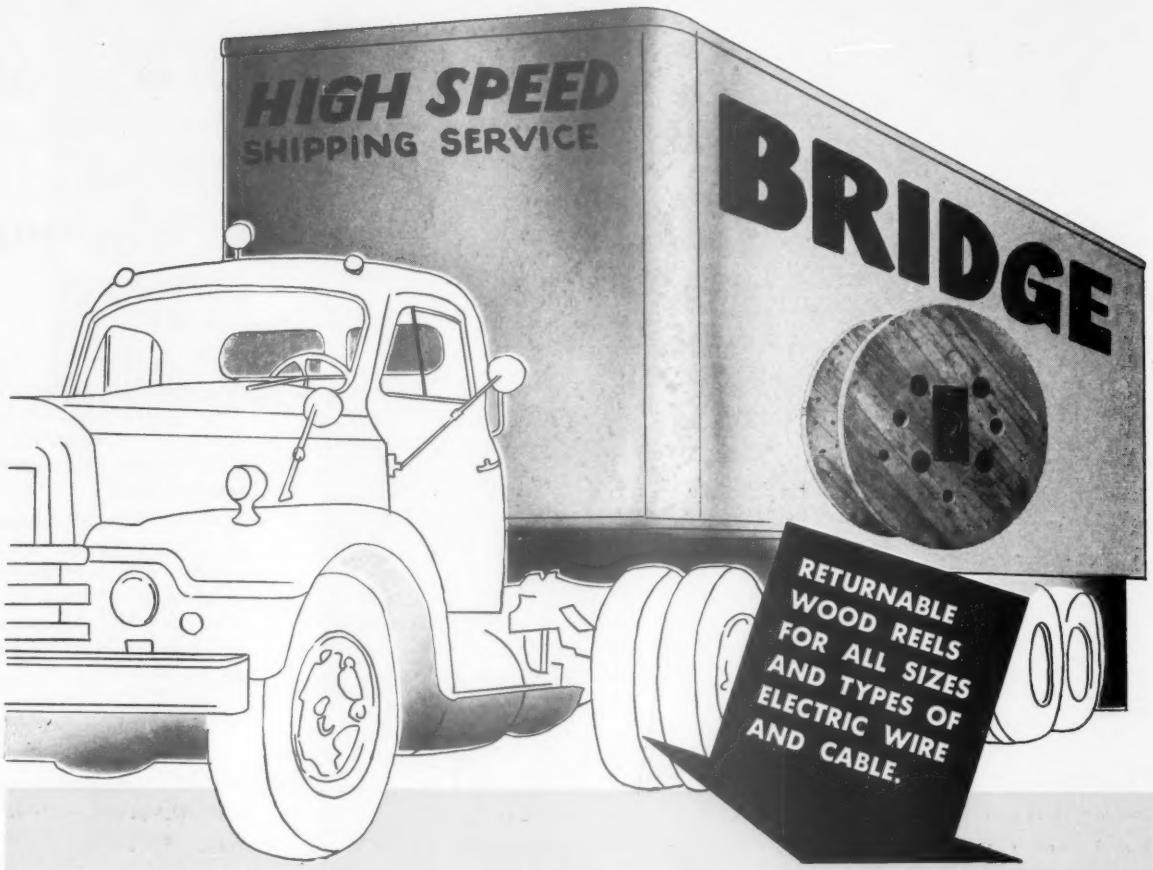
• GET YOUR SHARE OF THE BUSINESS . . . . . .

• ADVERTISE IN WIRE AND WIRE PRODUCTS . . .

• SEND FOR ADVERTISING RATES TODAY . . . . . .

WIRE and WIRE PRODUCTS

453 MAIN STREET • STAMFORD, CONN.



EVERY TYPE OF WOOD REEL—

Returnable or Non-Returnable for the WIRE INDUSTRY . . . from 10" to 10' in diameter.

STRAIGHT LINE production methods produce accurately-made REELS of HIGHEST QUALITY at prices that make it good business to buy from BRIDGE.

A completely MODERN plant, with the very FINEST and FASTEST equipment, much of it specially designed for BRIDGE, assures you of rapid SERVICE and STRONG SERVICEABLE REELS.

HIGH SPEED
SHIPPING SERVICE IN OUR OWN TRUCKS

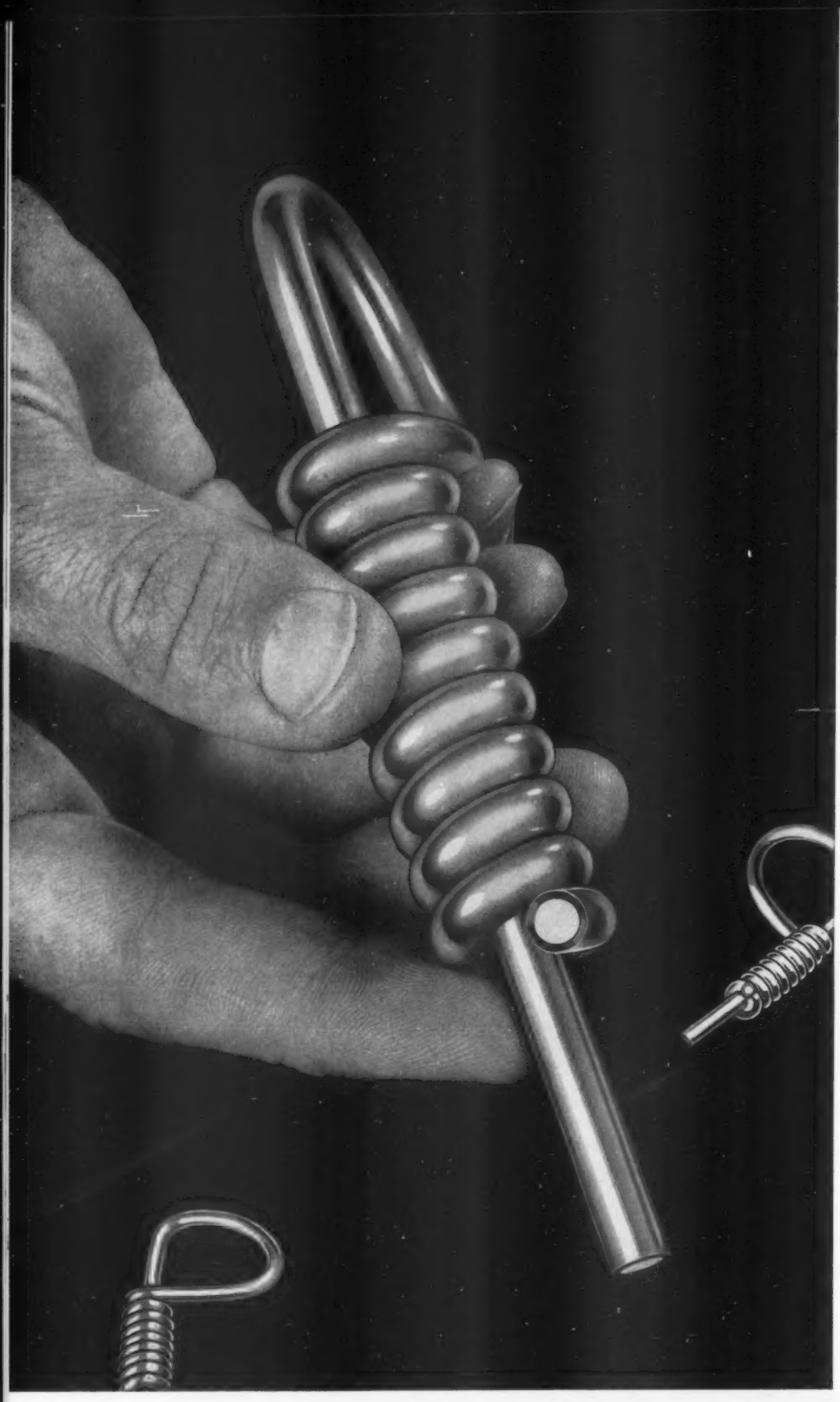
within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

RETURNABLE REELS ARE BUILT TO PROVIDE MANY TRIPS WITHOUT REPAIRS.

"REEL GOOD . . .

Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"



Get as "rough" as you want with

Copperply® wire!

Even the most severe usages known cause no measurable deterioration of the copper coating on Copperply Wire. This is both field and laboratory proved!

Shown here, for example, are standard wrap test specimens. Despite this extreme bending, neither microscopic examination nor ferroxyl testing show any hint of coating fracture or porosity.

You may well ask why. For one thing, the National-Standard electroplating process provides a homogeneous, high density coating . . . and, regardless of wire size, the maximum variation in copper thickness is less than 1% of diameter!

Copperply wire, offering you unmatched uniformity and service life, is available in the popular ASTM 30% and 40% conductivity grades. In addition, the precise control of the process permits the deposition of lighter coatings with the same degree of concentricity for varied electrical, electronic and mechanical applications where less copper is required. Copperply wire can be custom-produced to the copper thickness to give you the exact degree of conductivity or corrosion resistance required.

Write National-Standard, Niles, Michigan, for comprehensive Data Bulletin 202.

NATIONAL NS NATIONAL-STANDARD Company NILES, MICHIGAN **STANDARD**

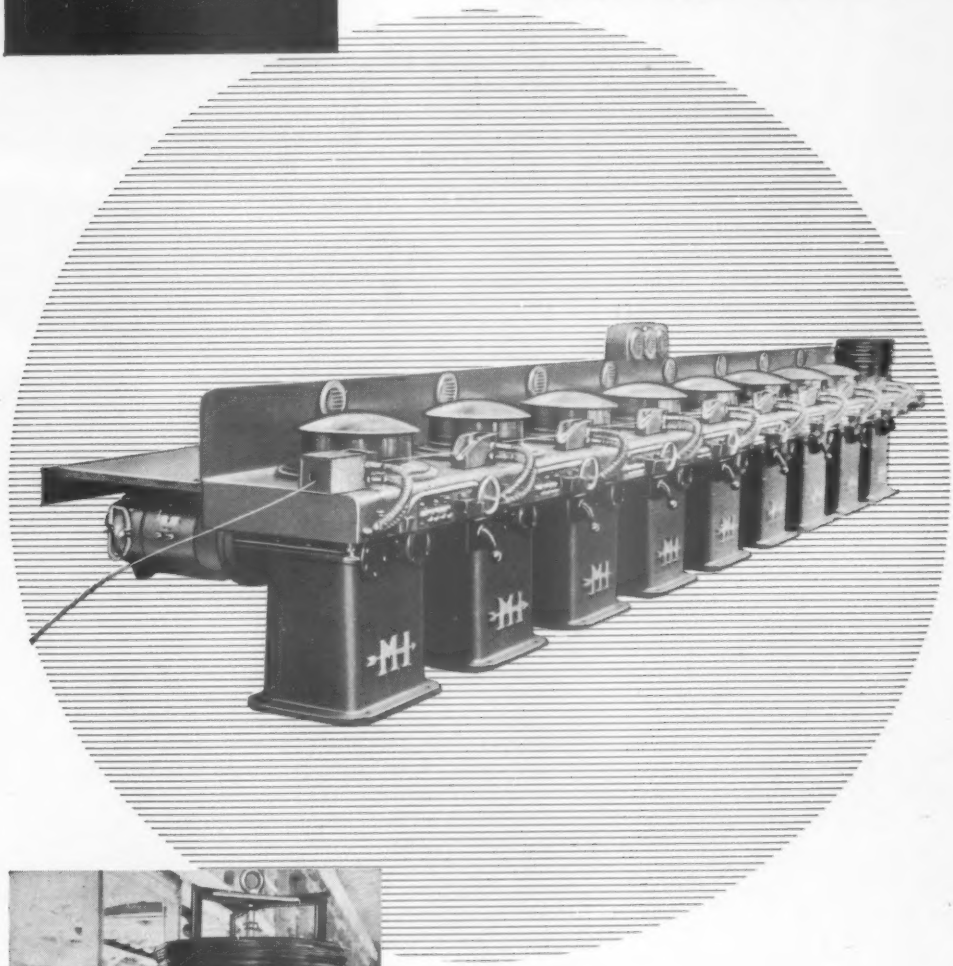
NATIONAL-STANDARD, Niles, Mich.; *fine wire, stainless, music spring and plated wires, flat and tubular braid and wire cord*
WORCESTER WIRE WORKS, Worcester, Mass.; *music spring, stainless and plated wires, high and low carbon specialties* • **REYNOLDS WIRE, Dixon, Ill.;** *industrial wire cloth*
WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* • **ATHENIA STEEL, Clifton, N. J.;** *flat, high carbon spring steels*
CROSS PERFORATED METALS, Carbondale, Pa.; *industrial, commercial, and decorative perforated metals*

Three sizes for all types
of material
Optional number of blocks

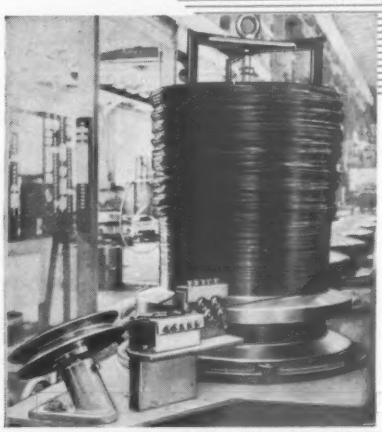
Our experience in building
wire drawing equipments
during 60 years
is your guarantee

THE BEELINE

**Designed and built to meet
today's requirements for trouble-free
high production wire drawing**



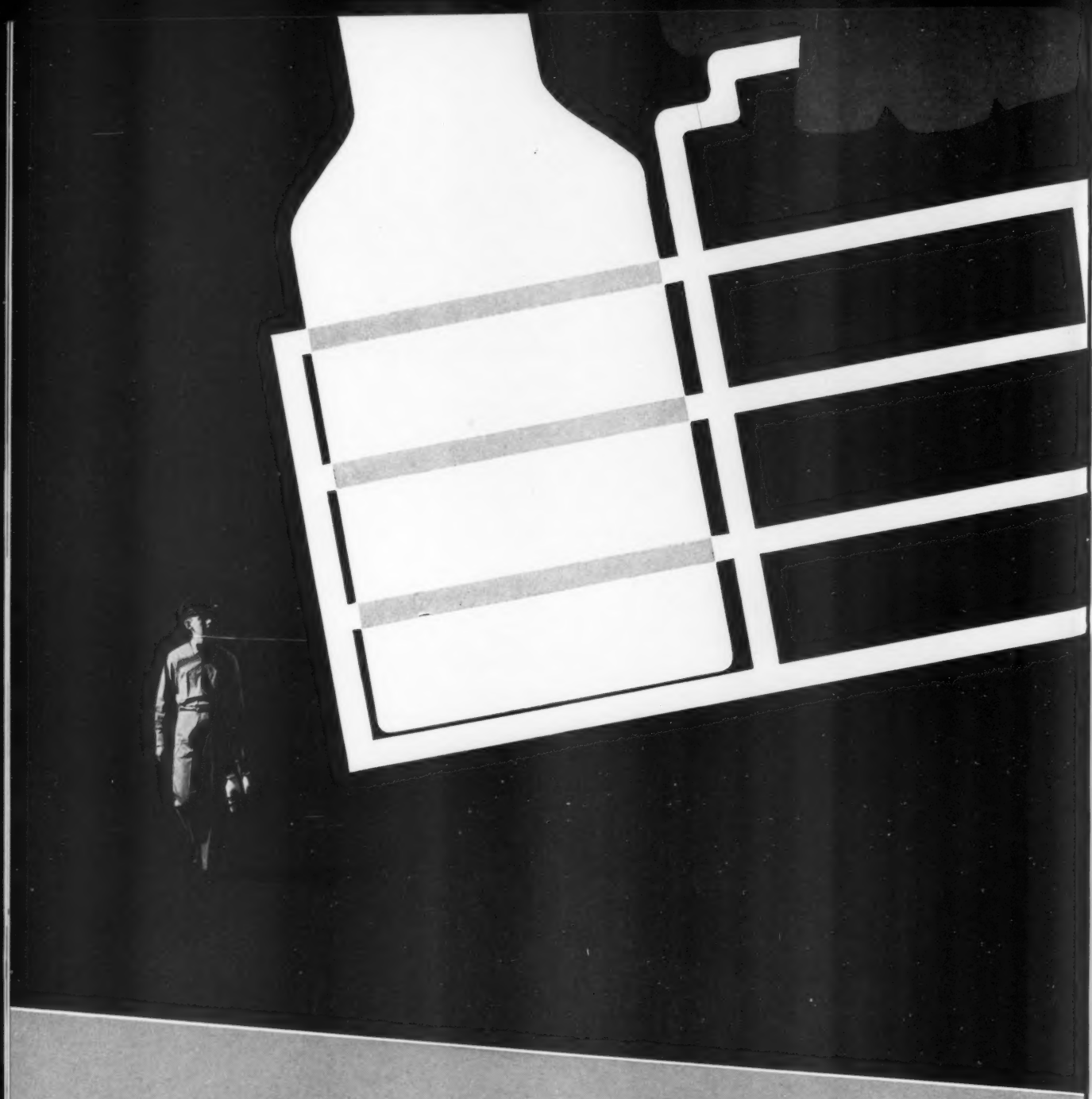
*The smallest size:
BEELINE DM 3 with
nine 16" blocks*



*Double decked finishing block
with straighening device*

MORGÅRDSHAMMAR
MORGÅRDSHAMMARS MEK VERKSTADS AB • MORGÅRDSHAMMAR • SWEDEN

Cable: Morgårdshammar, Ludvika. Telephone 0240-71100.
U S office: 19002 Lomond Boulevard Cleveland 22, Ohio.



a profitable idea!

You'll sell more by telling your customers that your product is made from lightweight, corrosion-resistant Alcoa® Aluminum. When you knock down the weight a man has to carry or push all day, he'll be less tired, able to do a better job. If you use wire in your product, check into the advantages of aluminum.

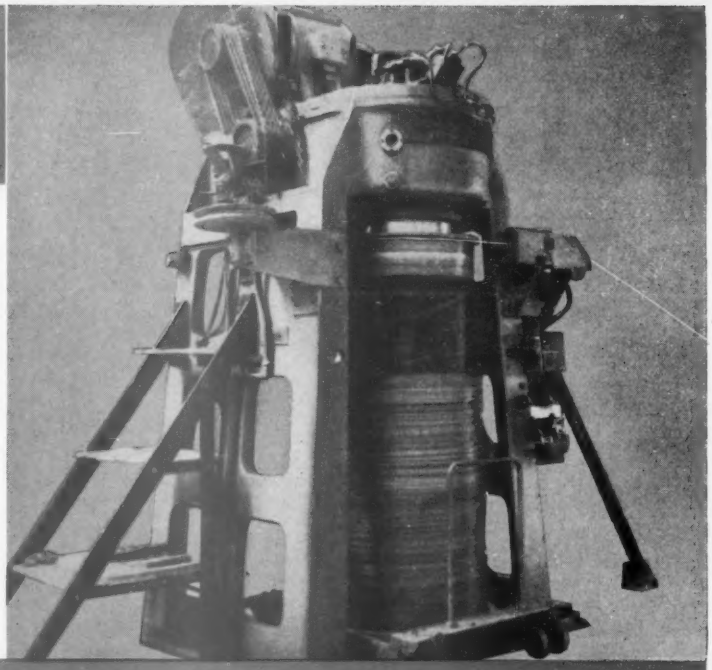
Alcoa has set up a special department to work with you on profitable new ideas, new uses for aluminum wire. For immediate action, write ALUMINUM COMPANY OF AMERICA, Wire Products Development, 1993-K Alcoa Bldg., Pittsburgh 19, Pa.

ALCOA ALUMINUM

Your Guide to the Best in Aluminum Value

ALCOA THEATRE • Fine Entertainment • Alternate Monday Evenings

Introducing



GRAVITY BLOCK MACHINE

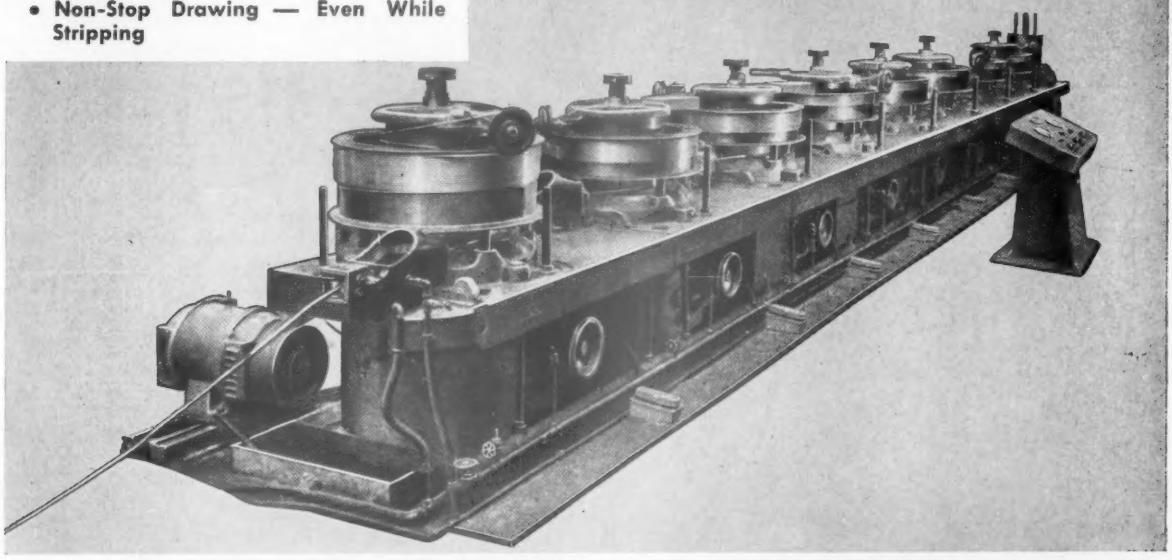
- Available in Single or Double Draft Design
- Block Diameters From 18" to 30"
- Coil Sizes—2,000 Pounds & *Larger*
- High Speed Stripping
- Ease of Handling Large Coils

The Sir James Farmer Norton & Company, Ltd. of Manchester, England, manufacturers of the famous line of Farmer Norton Wire Drawing and Fence Making Machinery have appointed the Steel & Wire Machinery Co. of Cleveland, Ohio, as exclusive Sales Agents in the United States.

FARMER NORTON

CONCENTRIC BLOCK MACHINE

- High Speed Straight Line Accumulation Type Wire Drawing
- Provides Excellent Cooling Between Drafts
- Non-Stop Drawing — Even While Stripping



EXCLUSIVE U.S. AGENTS FOR WIRE DRAWING & FENCING MACHINERY

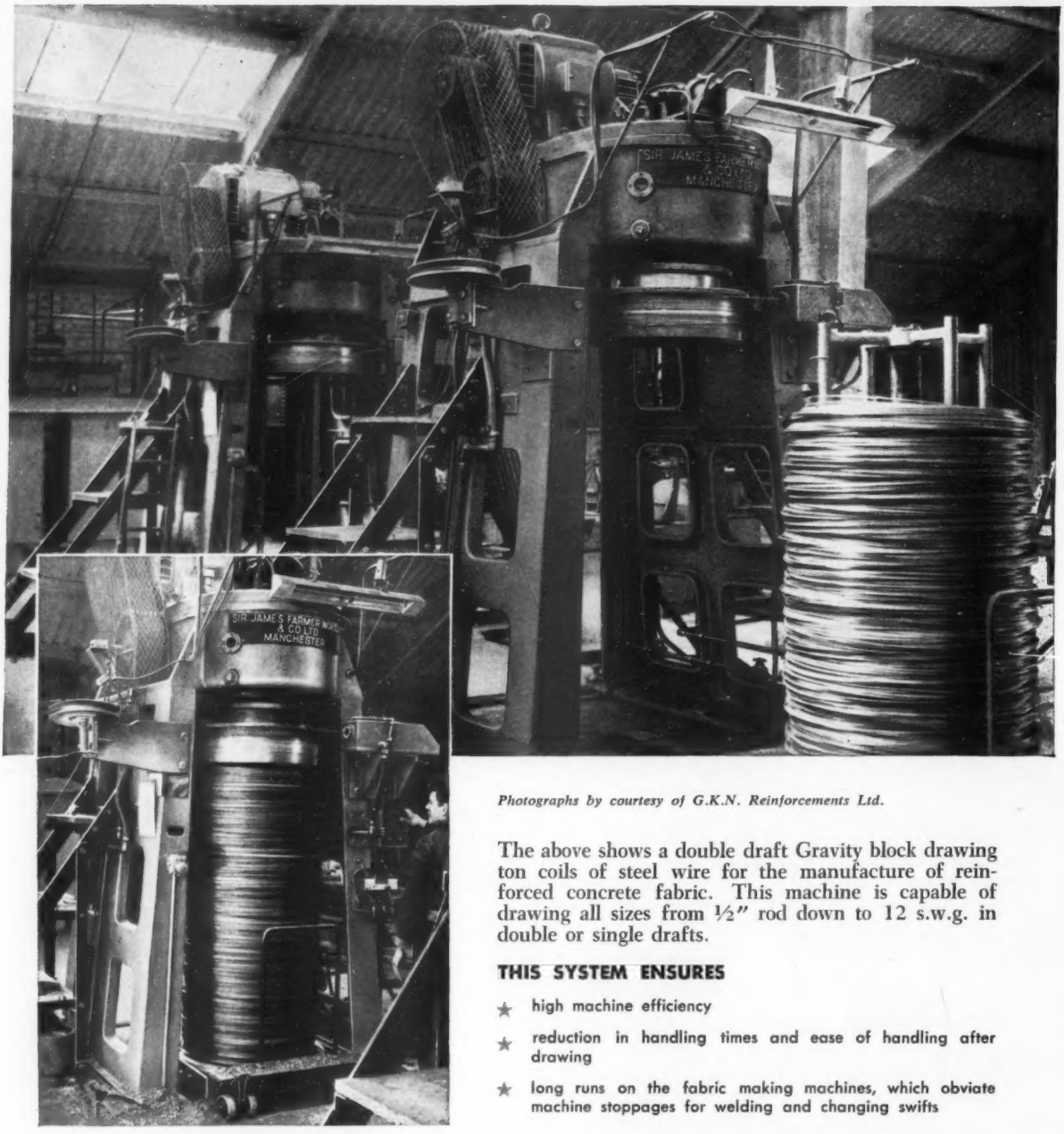
Steel & Wire machinery co.

EQUIPMENT FOR THE MANUFACTURE OF STEEL AND WIRE PRODUCTS

FARMER NORTON
Draw Benches, Rolling Mills, Flattening Mills Slitters & Pointers

15457 EUCLID AVENUE • CLEVELAND 12, OHIO

Farmer Norton



Photographs by courtesy of G.K.N. Reinforcements Ltd.

The above shows a double draft Gravity block drawing ton coils of steel wire for the manufacture of reinforced concrete fabric. This machine is capable of drawing all sizes from ½" rod down to 12 s.w.g. in double or single drafts.

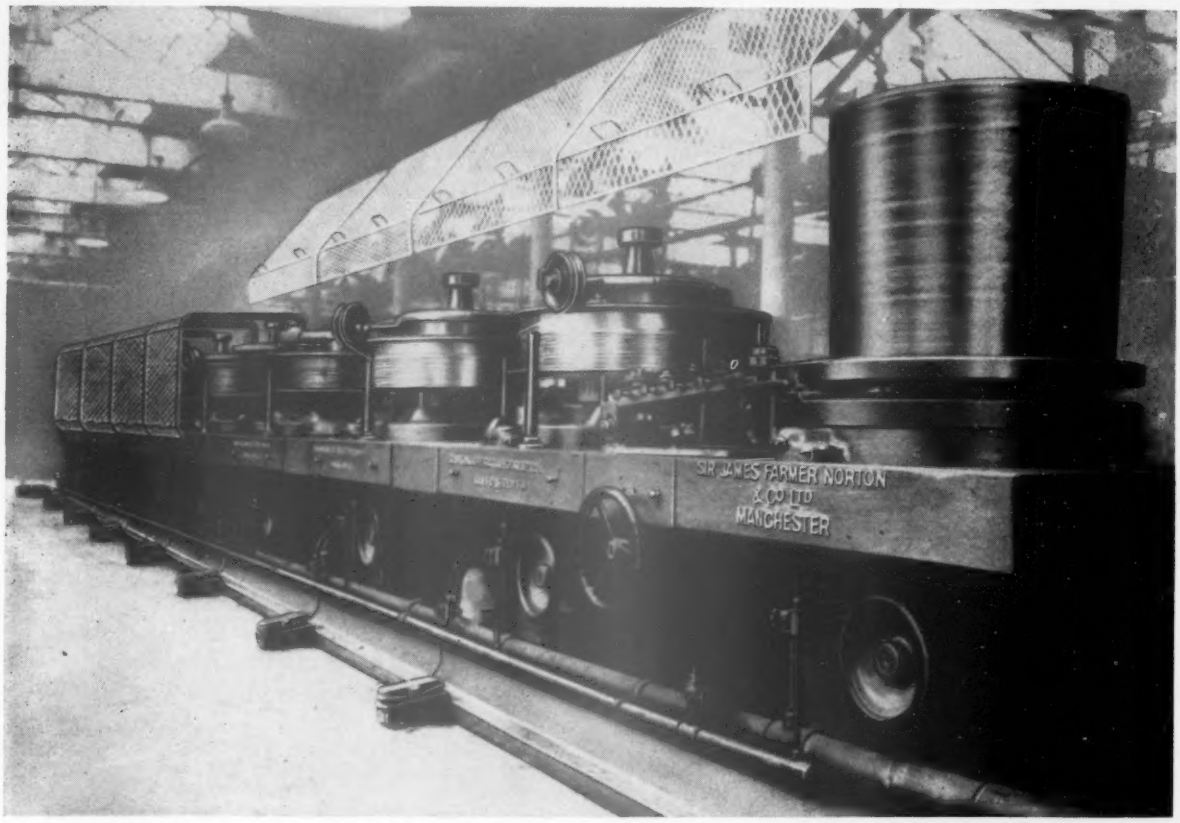
THIS SYSTEM ENSURES

- ★ high machine efficiency
- ★ reduction in handling times and ease of handling after drawing
- ★ long runs on the fabric making machines, which obviate machine stoppages for welding and changing swifts

Makers of all classes of Wire Drawing Machinery and pioneers of the inverted block system for handling large coil weights.

Sir James Farmer Norton & CO. LTD.

—WIRE DRAWING MACHINERY



CAPACITY CHART

for eight-die high-speed machine with winder

Ingoing Wire Size (ins.)	.212	.16	.212
Finishing Wire Size (ins.)	.064	.048	.048
Speed of last Drawing Block (ft/min)	1500	2000	2500
Max. Speed of Winder Block (ft/min) from P.I.V. Gear	1875	2500	3125
Horse Power per Block	25	25	30
Content	.6/.7% Carbon	.6/.7% Carbon	Up to .25% Carbon

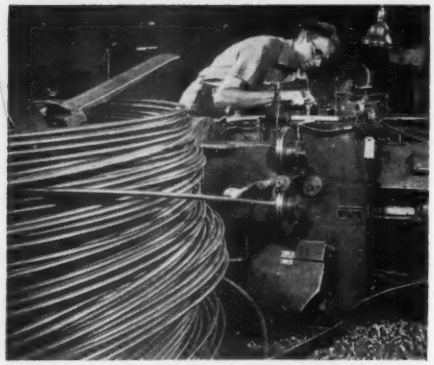
HIGH SPEED ACCUMULATION WIRE DRAWING MACHINE

This design draws straightline, **ELIMINATING THE TWIST** usually associated with accumulation machines. Due to the double accumulation, the wire is well cooled between drafts. The outer race being in no way connected to the inner block, there is no heat transfer. **THIS RESULTS IN HIGH QUALITY WIRE.** In the case of flying dogs on threading up, or wire breakages during running, the operator is well shielded by the outer race. **NO ACCIDENTS CAN OCCUR.** It is not necessary to stop the machine to empty the finisher. **NON-STOP PRODUCTION IS OBTAINED.** Shown, left, are just some examples of recommended speeds for steel wire drawn on concentric block wire drawing machines.

We build these machines in any size depending on the wire to be drawn.

ADELPHI STREET • SALFORD • LANCASHIRE • ENGLAND

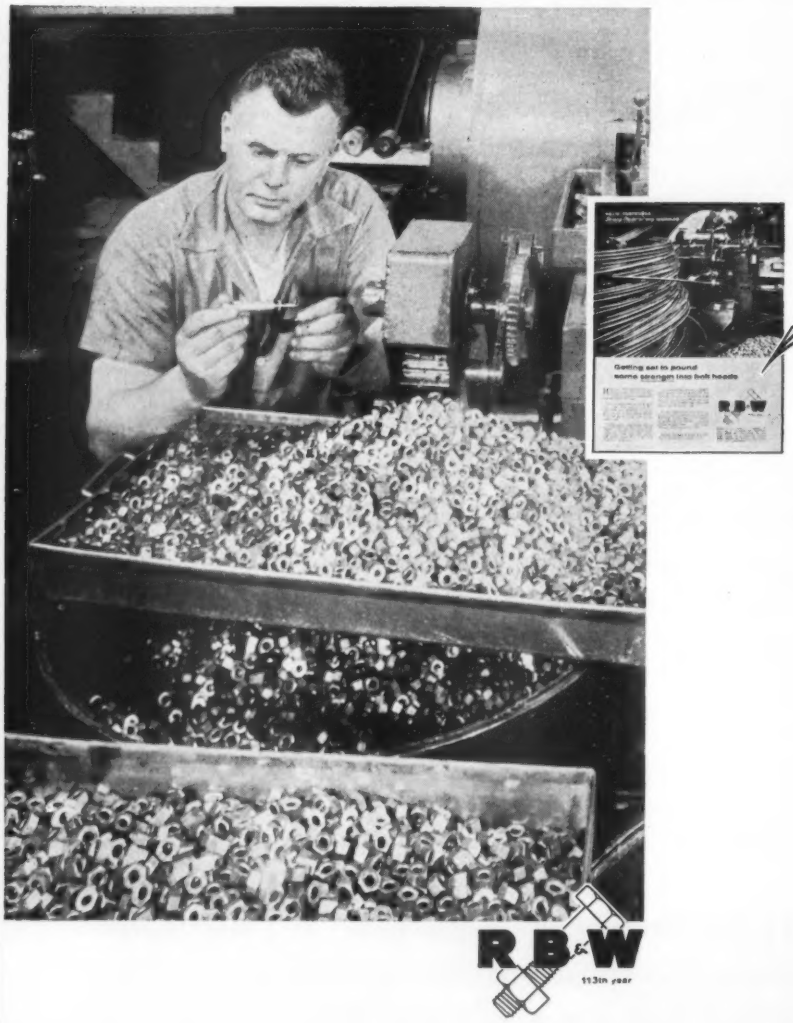
Sole Representative in U.S.A.: Steel & Wire Machine Co., 15457 Euclid Ave., Cleveland 12, Ohio. MUlberry 1-7151



This modern Cold Header forces wire drawn from Youngstown Rods to flow inside the dies. It spills out bolt or screw blanks by the thousands— every hour, all day long.

Accent on Excellence

Youngstown cold heading and scrapless nut quality rods and bars



Russell, Burdsall & Ward Bolt and Nut Company of Port Chester, N. Y. is one of the world's largest and best known fastener producers with plants at Coraopolis, Pa., Rock Falls, Ill., and Los Angeles, Calif. They stated in one of their recent advertisements:

"The cold heading method (an RB&W development that revolutionized bolt making) calls for use of uniform, high quality raw material. With constant quality control, RB&W makes sure our cold headers get the proper 'diet'."

Youngstown's Cold Heading and Scrapless Nut Quality Rods and Bars in coils answer RB&W's rigid requirements. They find them to be internally sound, uniform in both physical structure and chemical composition—as well as free from injurious seams and slivers, which cause rejects, reduced profits.

Wherever steel becomes a part of things *you* make, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create products with an "accent on excellence".

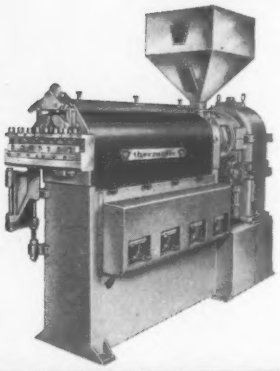
QUALITY YOUNGSTOWN SERVICE

THE
YOUNGSTOWN
SHEET AND TUBE COMPANY

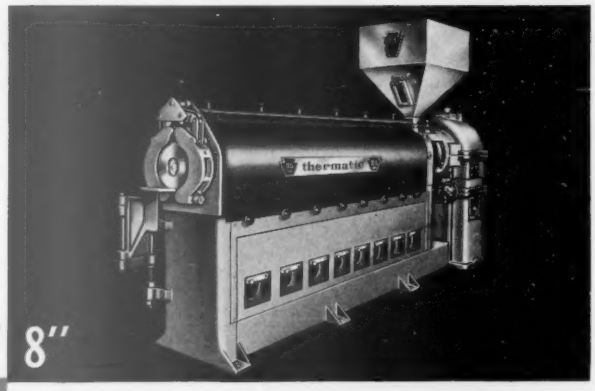
Manufacturers of Carbon, Alloy and Yoloy Steel
Youngstown, Ohio

SIZE for SIZE

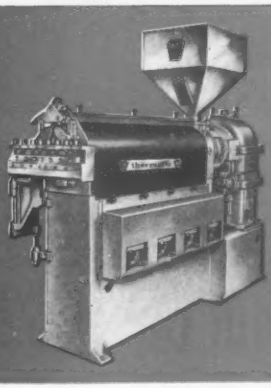
A New thermatic Series* extruder will outproduce any extruder on the market



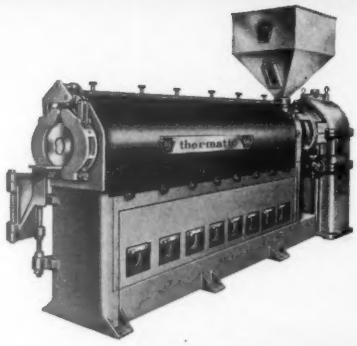
4½"



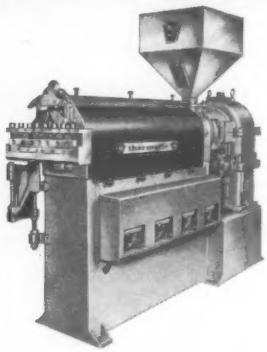
8"



3½"



6"



2½"

	2½"	3½"	4½"	6"	8"
More Horsepower Capacity	64	107	142	209	308
Higher Screw Speeds	200	150	110	85	60
Greater Output (lbs./hr.)*	200	375	600	900	1500

*PE (20,000 mol. wt., 4.0 melt index, 0.92 sp. gr., 500°F., 3000 p.s.i)

*Patented

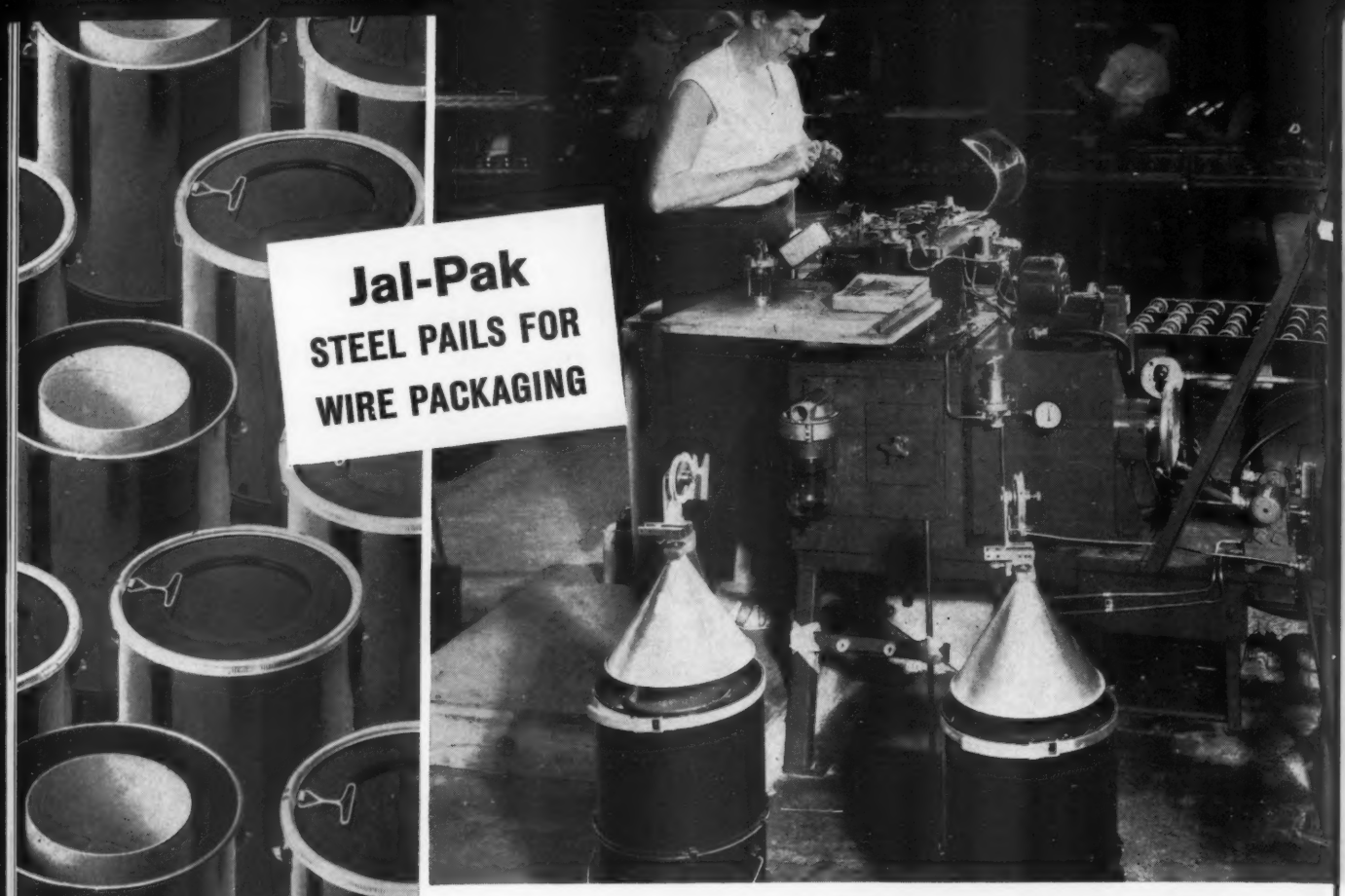
Complete Details are Available Now. Write or Call

DAVIS - STANDARD

Division of FRANKLIN RESEARCH CORPORATION

6 WATER STREET, MYSTIC, CONNECTICUT

In Canada contact E. V. Larson Co. Ltd., 572 Queen St. East, Toronto 2, Ontario/in Europe and the Sterling Area contact Fawcett, Preston & Co. Ltd., Bromborough, England/in Chicago contact C. J. Beringer Co., 5522 Milwaukee Ave., Chicago, Illinois/in California contact Seaboard Machinery Co, 3212 East Olympic Blvd., Los Angeles 2, California.



This operator is winding 27-gauge wire at 300 feet per minute from Jal-Pak pails supplied by Rea Magnet Wire Company, Inc. In other operations, Fasco has de-reeled wire as fast as 2700 feet per minute.

"We reduced labor costs $20,000 a year with Jal-Pak pails"

... reports FASCO INDUSTRIES, INC.

"We have saved up to $20,000 a year in labor costs alone by using these wire pails for handling copper magnet wire from 25 to 31 gauge," states Mr. Charles Weiland, director of purchases of Fasco Industries, Rochester, N.Y. "Other savings result in reduced scrap loss and the elimination of wire spools."

Jal-Pak steel wire pails prevent wire breakage, snarling and kinking of wire. Complete protection is assured by smooth side seams and inner surfaces. Rethreading and rejoining are materially reduced. No deposit or return are required.

Some companies have reduced downtime as much as 90% in packaging wire with Jal-Paks. The unique pails are now successfully used with brass, copper, steel, aluminum, stainless steel, alloys, welding and soldering wires.

For facts on how Jal-Paks can cut your costs, write direct to Jones & Laughlin, Container Division, 405 Lexington Avenue, New York 17, New York.

Jones & Laughlin Steel Corporation

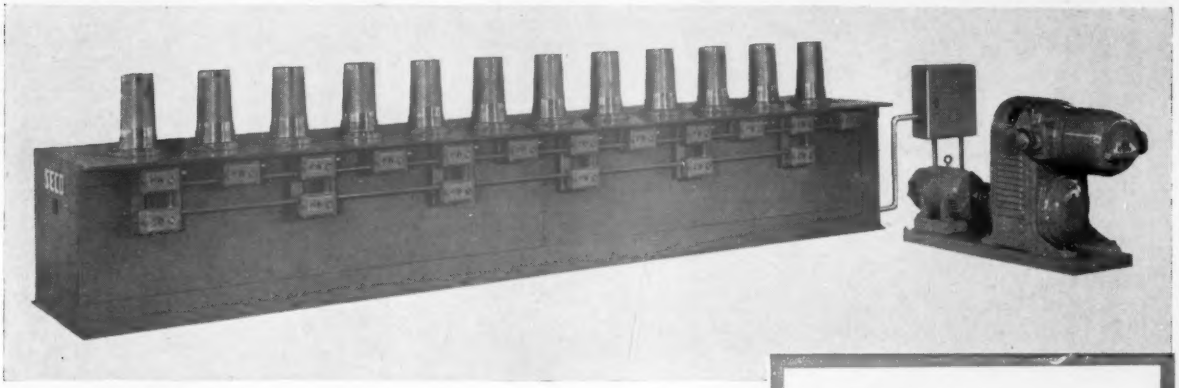
CONTAINER DIVISION

405 LEXINGTON AVENUE, NEW YORK 17, NEW YORK

J&L STEEL

SECO Fine wire TAKE-UP FRAMES

The "last-word" in wire-winding efficiency!



- **Simplified Design and Construction**
- **Synchronized Electrical Variable Speed**
- **Noiseless, Vibrationless Running**
- **Greatly Increased Operating Capacity**

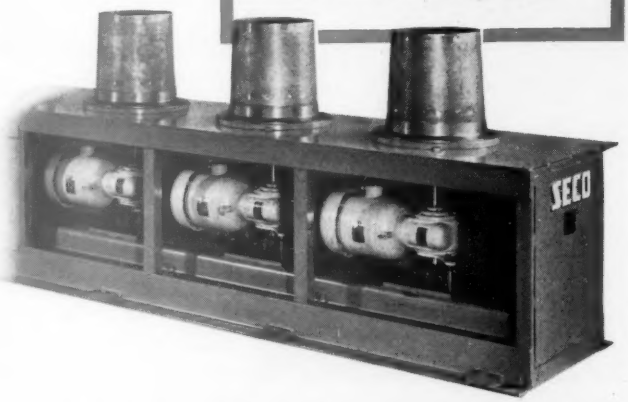
SECO builds take-up frames for handling fine gauge steel or non-ferrous wire on 8", 12", or 16" diameter blocks...with linear wire speeds up to 1,000 FPM or higher. Superior features include a multiple electrical drive system (alternating current) for synchronized electrical transmission of variable speed power.

This gives simultaneous speed changes to all spindle blocks, in ratios up to 5:1 or even 10:1 or higher. It provides push-button stop-start control to each of the gear motors driving each spindle block. Gone is the old bevel gearing, with manually operated clutches for starting and stopping the blocks.

SECO high production take-up frames are constructed to accommodate any number of spindles required. Frames with horizontal spindles can also be built. Call or write for complete information and data. Consultation invited—no obligation.

SHOWN ABOVE:
SECO Take-Up Frame and VARIDYNE Electrical Power Unit which provides synchronized variable speed to the multiple drives. AC current is employed throughout, and the VARIDYNE System "gears" all the drives together by electrical impulses.

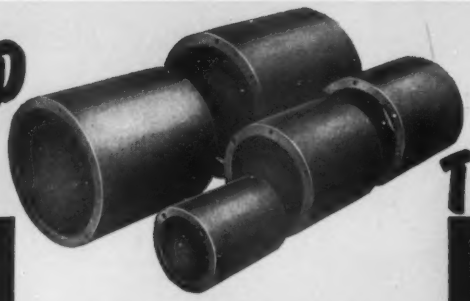
SHOWN BELOW:
The AC squirrel-cage induction type gear motors which drive the spindle blocks through hollow bored shafts.



STEEL EQUIPMENT COMPANY
P. O. BOX 737, WARRENSVILLE STATION
CLEVELAND 22, OHIO

SECO

HUBBARD TRAVERSES



EASILY ASSEMBLED IN 4 RAPID STEPS TO SAVE COST AND TIME

1 PLACE BOLTS IN REEL HEAD

2 SET HEAD ON FLOOR, BOLTS UP

3 TRAVERSE POSITIONED ON WOODEN HEAD

4 TOP HEAD LAID ON TRAVERSE AND BOLTED DOWN

HUBBARD TRAVERSES are made for nailed wood, plywood, metal bound and cast flanges, constructed of one sheet of metal—rolled, welded and flanged—in painted galvanized or plain finishes . . . easy to assemble and to repair . . . reduces damage to cable . . . increases life of reel due to rigid one piece barrel.

Besides TRAVERSES, every type of REEL and SPOOL—returnable and non-returnable in all materials is made by HUBBARD for shipping and shop use.

WRITE FOR PRICES AND COMPLETE INFORMATION.

HUBBARD SPOOL DIVISION

The American Pulley Company

GARRETT, INDIANA

The Wire Outlook

The note of optimism on the speed of recovery of business now needs some further upward revision. It has come along faster and on a wider base than thought possible even a month ago.

In the summer of 1957 business was operating at a gross national product (GNP) rate of 445 billions; last spring the rate had fallen to 425 billions; presently it has gone up to 439 billions and is climbing rapidly. If the up-swing of the curve continues unabated, the first half of 1959 should see the country over the previous high mark.

Long and costly strikes appear to have been averted. The new automobile models have been greeted with something of the old enthusiasm and, if it keeps up, will tend to push the business curve up. The public, with renewed confidence, is beginning to get deeper into installment buying, and deficit spending on the part of the government is doing its bit to spur business. It is, however, definitely an inflationary force for which we will pay in higher taxes and prices.

The steel industry is reflecting the returning vigor of business and as of October first had risen to an average of 68.5% of capacity. Next year is foreseen an increase of 25%, with a production of 108 million ingot-tons. Much added business will come from autos, machinery, railroads, oil producers, container manufacturers and produce growers.

Automobile sales are estimated to go to 6 million cars—up 1.5 million from this year. Construction, now high, may show some gain. Most machinery sales will come from replacement of obsolete equipment, as widespread expansion projects are not yet in prospect. Old machinery does not pay.

Bankers, always conservative in the matter of loans, feel that prosperous times are ahead. Their one doubt is that the Federal Reserve Board's plans to prevent inflation through tighter money and credit may choke off the recovery before it attains major proportions.

Unemployment is expected to remain high this year, but in 1959 more jobs should be available. Yet from a number of sources it is reported that good, skilled workers are hard to locate.

Personal income, at a low point of $347.2 billions in the first quarter, as against $351.8 in the third quarter of 1957, may reach an annual rate of $378.8 billions in 1959, according to an economic survey and forecast. Matching this, consumer spending was $288.3 billions in the third quarter of 1957, $286.2 billions in the first quarter of this year, and is projected to $306.4 billions in 1959.

Most wire items are responding to improved general conditions. Merchant wire sales took a sharp upturn in the summer, but the seasonal tapering off will soon take effect. Barbed wire was among the better-moving items. High carbon wire bookings rose nearly 15% in September and fastener, cold heading, and spring grades of wire were more active. Automotive wire demand, in keeping with increased production, has been a bright spot. Road building and pipe reinforcing mesh are moving well. Manufacturers' wire is doing better, with producers operating at an average of 60% of capacity. Low carbon wire sales, while up, are not as good as some of the specialties.

One survey has concluded that business will develop well because: government outlays have increased; consumers are spending more liberally; inventories are low and need replacement; prices will not go much higher; profits will climb; investment in new plant and equipment will stabilize; and the needs of a growing population—3 million more each year—must be met.

As encouraging news regarding the trend of the state of the nation pours in, this in itself tends to create a confidence that leads to sound improvement. There is a lot of psychology in business and activity is sensitive to opinion.

During the long dry spell of the recession, the country was fortunate to have had so many men of vision who voiced their conviction that the basic economy was sound and that the flood tide of demand could not long be stemmed by fears.

Edmund Duval Sickels
EDITOR

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Symposium on Aluminizing

Joint Ferrous and Non-Ferrous Division
Technical Session
October 13, 1958
MODERATOR
C. C. Tappero, Wire Mill Superintendent
The Colorado Fuel & Iron Corporation
Pueblo, Colorado

Aluminum Coating of Steel Wire

by H. J. Godfrey, Assistant Chief Engineer
Research and Development
John A. Roebling's Sons Corporation
Trenton, New Jersey

As an introduction to this Symposium we shall discuss the general characteristics of aluminum coatings and the methods by which they are produced.

★ ★ ★

The interest in aluminum coated steel wire is due to the good corrosion resistant properties of aluminum and its low cost per unit volume. Aluminum resists corrosion in many types of atmosphere and has been considered to be an ideal coating material for many years.

★ ★ ★

There have been, however, many technical problems associated with aluminum coating and they have retarded the development of a satisfactory process for aluminizing steel wire. At the present time aluminum coated steel wire is being produced on a limited basis by only a few companies.

★ ★ ★

The effectiveness of aluminum as a corrosion resistant material has been illustrated in a study[1] on aluminum clad coatings reported by The American Society for Testing Materials in 1946. These tests showed that after ten years exposure under several different corrosive atmospheres the amount of corrosion on the clad materials was very limited. The cladding on these test samples was at least 99% aluminum.

★ ★ ★

The superiority of aluminum coated steel sheets over galvanized sheets was reported by Merritt and McFee[2] in 1956. After twelve years exposure in industrial atmospheres the zinc coating on the galvanized samples was completely gone and the samples were covered with rust. The aluminum coatings were intact with every indication that they would provide protection for several more years.

★ ★ ★

The results of corrosion tests on aluminum coated hardware, structural shapes and tubes were reported in the A.S.T.M. Proceedings[3] in 1952. After twenty-three years of exposure at State College, Pa. and Sandy Hook, N. J. the aluminum coatings were in good condition.

★ ★ ★

The adoption of aluminum coatings for wire has been at a much slower rate than for sheets. For this reason there has been little factual data in the literature on the corrosion resistance of aluminum coated wire made on a production basis.

★ ★ ★

Westerman[4] reported in 1955 that tests at that time indicated that in an industrial and highly humid atmosphere aluminum coatings on wire were substantially superior to equivalent thicknesses of galvanized coatings.

★ ★ ★

At a meeting of the Sea Horse Institute at Wrightsville Beach, North Carolina, this past June, considerable data were presented on the corrosion resistance of aluminum coated steel wire in a marine atmosphere. These data were presented by Miss Jane Rigo of the American Steel and Wire Co. and indicated that aluminum coatings were superior to galvanized coatings, particularly after three or four years of exposure.

★ ★ ★

It is of interest to note that in 1938, just twenty years ago, Dr. Colin G. Fink[5] of Columbia University described a method of producing aluminum coated steel wire before the Annual Meeting of The Wire Association. With the corrosion resistant properties of aluminum well established it is reasonable to conclude that there are some rather difficult problems connected with the coating of steel wire since this product has just recently been placed in production.

★ ★ ★

There are several methods by which steel can be coated with aluminum and a brief description of these processes are as follows:

1. Calorizing

Articles are packed in a mixture of powdered aluminum, aluminum oxide and ammonium chloride and heated in hydrogen at about 1650° F.

2. Spraying or Metallizing

An aluminum wire or powder is melted in an oxyacetylene flame, atomized by an air blast and sprayed on the steel surface. The coating is porous and no alloy layer is formed. By subsequent heating in a neutral or reducing atmosphere the coating is improved and becomes alloyed to the base metal.

3. Cladding

Roughened clean steel is sandwiched between two aluminum strips, rolled at room temperature and annealed at 1000°F after rolling. A recent paper by Storcheim[6] describes the effect of temperature and pressure on the bonding properties of aluminum clad steel.

4. Electro-Plating

Non-aqueous baths of aluminum salts have been used for electroplating baths. Difficulties in getting adherent coatings and maintaining plating baths have retarded this method.

5. Vapor Plating

In this process the steel is placed in an aluminum chloride vapor at a temperature of 1700°F. Other vapors such as aluminum hydride have been suggested for vapor plating. The coatings obtained with the vapor plating process are very thin.

6. Alumoweld Process

This is a recent development for putting an aluminum coating on steel rod which is then drawn into wire. The Alumoweld Process will be described later in this Symposium.

H. J. Godfrey

The author was born in Needham, Mass., and graduated from Tufts College in 1931 with a B.S. in Civil Engineering. He held a Research Fellowship at Lehigh University from 1931 thru 1933 and graduated with an M.S. in Civil Engineering. From 1934-1937 he was a Research Engineer for the John A. Roebling's Sons Company. From 1937 to 1941 he was Engineer of Tests at the Fritz Engineering Laboratory at Lehigh University. He rejoined Roebling in 1941 as a Development Engineer.

This paper, a part of the Symposium on Aluminizing, was prepared for presentation at the Annual Convention of The Wire Association on October 13, 1958, at Atlantic City, N. J.

7. Hot Dip Process

Except for the Alumoweld process the only practical coating process for aluminizing steel wire at the present time is the hot dip process which has been used successfully for steel sheet and hardware.

★ ★ ★

The major steel companies have been engaged in developing a hot dip process for wire, and we at Roebling have also been experimenting with this process.

★ ★ ★

The hot dip process for aluminum is, in general, similar to hot dip galvanizing. However, considerably more attention must be given to the preparation of the wire surface prior to immersing into the molten aluminum.

★ ★ ★

The problems associated with aluminizing are due primarily to the high affinity of aluminum for other materials. For example, aluminum will readily combine with oxygen in any form and the aluminum oxide product on the wire surface prevents the aluminum from alloying to the steel. Aluminum oxide is a very stable refractory material and cannot be reduced by any simple chemical process. It is therefore necessary to remove all oxides and surface contamination from the surface of the wire and maintain this condition until the metal makes contact with the clean molten aluminum.

★ ★ ★

The wire drawing coatings may be removed by first heating the wire in a lead bath or flame. In regard to the wire drawing lubricant itself, it is believed that lime-free soaps are more desirable because they are more easily removed from the wire surface.

★ ★ ★

In order to provide the best possible cleaning the use of alkali cleaners for degreasing may also be used prior to acid cleaning. Molten salt baths should also be considered as a means of getting satisfactory cleaning for aluminizing.

Following the previous cleaning operations the wire should be cleaned in acid and then thoroughly rinsed to remove acid and salts from the wire surface.

★ ★ ★

After having cleaned the wire the next problem is to maintain a clean surface until the wire enters the aluminum bath. This can be done by the following three methods:

1) **Protective coating.**
2) **Flux coatings—aqueous or molten fluxes.**
3) **Gas atmospheres.**

Protective Coatings

Metallic coatings such as copper, zinc and cadmium have been suggested but such methods have been costly and also resulted in contaminating the aluminum bath. The contamination due to copper in particular results in a reduction in the corrosion resistance of the coating.

★ ★ ★

Non-metallic coatings such as Glycerol have been described by Hughes[7]. A thin coating of Glycerol is applied to the cleaned steel surface and burns off as it enters the aluminum bath.

Aqueous and Molten Fluxes

Westerman[4] describes the use of an aqueous flux used by The American Chain and Cable Co. This flux consists of a solution of zirconium and titanium fluorides which should be dried before entering the aluminum bath.

★ ★ ★

The Moeller[8] process is an example of the use of molten salts. In this process the clean wire passes through a bath of molten barium chloride and sodium chloride which has a higher density than aluminum. A layer of molten aluminum floats on top of the salt and the steel wire is coated as it passes up through the aluminum.

★ ★ ★

Another example of the molten salts is the General Motors' Aldip[9] process which uses a molten flux containing fluorides. The Aldip process has been used successfully for coating hardware but has not been used for wire.

Gas Atmospheres

In a method developed by Fink[5] the steel was cleaned by degreasing and acid pickling. After cleaning the wire was then heated in a hydrogen atmosphere at about 1800°F. The hydrogen reduced any oxides present on the wire and decarburized the wire surface. The wire then entered the aluminum bath while under the protection of the hydrogen atmosphere which also protected the surface of the aluminum from oxidation.

★ ★ ★

The Sendzimir[10] process also uses a non-oxidizing atmosphere and includes a preheating operation prior to entering the reducing gas. The preheating forms a thin oxide layer varying from a light yellow to gray in color and is reduced to pure iron in the reducing atmosphere.

Hot Dipping

The operating temperature of the aluminum bath is 1250°F to 1300°F and for this reason as well as the chemical activity of the aluminum the aluminizing process offers more problems than hot galvanizing at 850°F.

★ ★ ★

Aluminum pots must be refractory lined and are generally heated electrically by induction or resistance heating. The sinker design for continuous aluminizing for wire is a serious problem because steel or iron will gradually dissolve in the molten aluminum. One of the best materials we have found in our experimental work is a refractory containing silicon-carbide and silicon-nitride. This material is not attacked by the aluminum and has good wearing properties.

★ ★ ★

When the wire is in the aluminum bath the metals react rapidly to form an iron-aluminum alloy layer on the surface of the wire. The alloy layer is hard and brittle and if it is thick the coating will crack when deformed.

★ ★ ★

The thickness of the iron-aluminum alloy layer can be reduced by three methods:

a) Reduce the rate of formation by adding certain alloys to the aluminum bath,

b) Reduce the time of immersion in the bath,

c) Maintain the temperature of the aluminum bath at a minimum.

★ ★ ★

A paper by Gittings[11] published in 1951 showed that silicon, copper and beryllium additions to the aluminum were very effective in reducing the thickness of the iron-aluminum layer.

★ ★ ★

Beryllium did not affect the brightness of the coating, whereas Silicon in amounts necessary to obtain a reduction in the alloy layer gave a gray appearance. Copper decreased the alloy layer but the aluminum-copper eutectic formed in the outer layers of the coating made the coating brittle.

★ ★ ★

T. F. Olts[11] in discussing Gittings' work advised that Armco aluminized steel sheets utilized a silicon addition to the aluminum bath to improve the ductility of the coating. Olts also indicated that beryllium was equally effective but was too costly. Armco[2] have more recently announced a silicon-free coating with improved corrosion resistance under atmospheric conditions.

★ ★ ★

Our experiments indicate that the thickness of the iron-aluminum alloy layer can be reduced by decreasing the time of immersion in the molten aluminum. For example, the iron-aluminum alloy layer was reduced 50% by increasing the speed of travel from 8 f.p.m. to 110 f.p.m. The thickness of the exterior aluminum coating, however, was not materially changed by the increase in speed.

★ ★ ★

The results of our aluminizing experiments on .062" diameter wires and smaller, indicate that the weight of coatings average about 0.2 ounces per square foot. This coating weight is somewhat less

(*Please turn to page* 1410)

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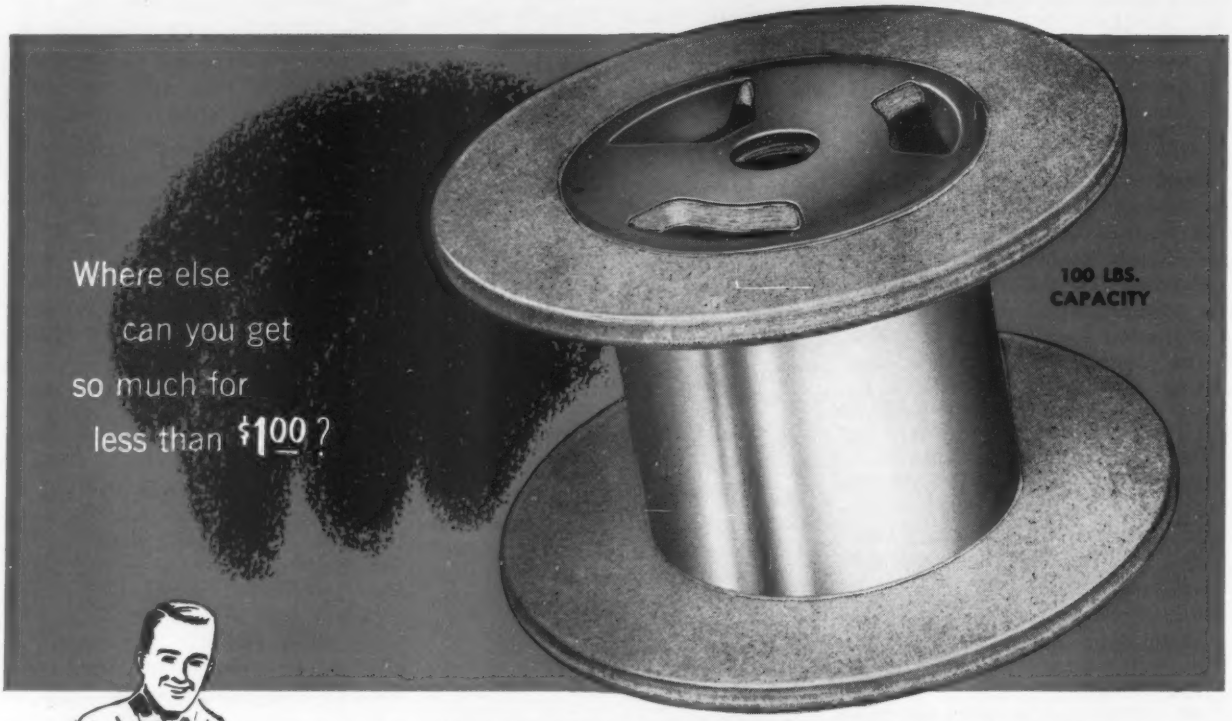

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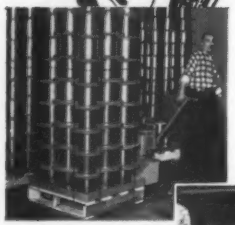

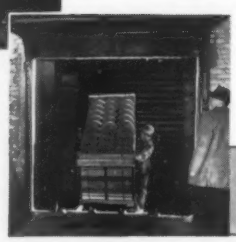

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Batch Type Aluminum Coating Of Small Steel Parts

by Robert F. Joy
Engineer, Development
Bethlehem Steel Company
Bethlehem, Pennsylvania

There are several methods currently in use to successfuly apply aluminum coatings to steel. The type product to be coated dictates to a large extent the procedure and method selected. In coating the multitude of small articles classified as pole line hardware and industrial fastener items, a batch type method is mandatory. It is this type process that will be discussed in this paper.

★ ★ ★

Early in 1955 an experimental pilot line designed to coat approximately 800 pounds of product per hour was installed. At the time of installation, no one had coated quantities of small products in bulk, nor had fasteners with clean coated threads been produced. After much experimentation a successful coating procedure was developed.

★ ★ ★

Briefly the process consists of:

1. **Precleaning**
   - (a) **Alkali degrease**
   - (b) **Fused salt bath**
   - (c) **Cold water rinse**
   - (d) **Acid pickle**
   - (e) **Cold water rinse**
   - (f) **Hot air dry**
2. **Preheating and fluxing**
3. **Aluminum coating**
4. **Removing excess aluminum**
5. **Cold water quenching**
6. **Inspection**
7. **Chemical dip for color identification (Optional)**

1. Precleaning

In the initial experimentation it was learned that an absolutely chemically clean surface is mandatory for a continuous aluminum coating. No grease, scale or surface soil of any kind can be tolerated. Therefore, following a dip in a proprietary hot alkali degreasing solution the parts are placed in a fused sodium hydroxide bath maintained at 900°F. About 200 to 250 pounds of product contained in a wire basket are handled at one time. The basket of parts remains in the fused caustic from 5 to 10 minutes during which time any remaining grease, oil or drawing lubricant is removed. At the same time, any scale present is converted to Fe_2O_3 in which form it is readily and quickly removed in the subsequent pickling operation.

Robert F. Joy

The author graduated in 1936 from the University of Pennsylvania with a degree of B.S. in Civil Engineering. He received his professional degree of Civil Engineer from the same school. In addition he studied metallurgy at the Penn State Extension School. He joined Bethlehem Steel Company in 1936 and presently is working in the Research Department.

This paper, a part of the Symposium on Aluminizing, was prepared for presentation at the Annual Convention of The Wire Association at Atlantic City, N. J., on October 13, 1958.

★ ★ ★

Following a water rinse the product is pickled in 8 to 10% sulphuric acid maintained at about 165°F. Pickling times required are from 5 to 15 minutes, less than one-half the time necessary without the caustic dip. Hydrochloric acid has been used but does not result in any noticeable benefits.

★ ★ ★

A forced hot air heating follows a water rinse. The product is dumped from the cleaning basket onto a vibrating conveyor which carries it to a storage hopper through which heated air is circulated. From this hopper, about 40 to 50 pounds of cleaned and dried parts are loaded directly into 12 inch diameter coating baskets, 20 inches high. Small amounts of rust that may form on the surface during storage are not detrimental to the coating. Such rust is removed by the fused salt flux.

2. Preheating and Fluxing

Preheating and fluxing is done in a 200-kw electric resistance furnace equipped with five pairs of overhung electrodes. The working space available is 18 x 90 x 40 inches (deep). There is ample capacity for five baskets in the furnace at one time, with an additional space for removal.

★ ★ ★

Each basket is suspended by a fiber rope from an overhead conveyor track. The loose end of each basket rope is attached to an air-activated moving bar which imparts constant vertical motion to the baskets while they are in the salt. Thus, any entrapped air is dissipated and each item is brought into intimate contact with the salt, assuring proper preheating and fluxing. See Figure 1.

★ ★ ★

The fluxing salt is of patented composition, consisting of 40% each of sodium and potassium

Fig. 1—Preheating and Fluxing Furnace.

chloride and 10% each of cryolite and aluminum fluoride. It is maintained at a temperature of about 1300°F. Parts remain in this flux for 10 to 15 minutes during which time the baskets are progressively moved from right to left in the furnace.

★ ★ ★

A 6 to 10 inch layer of aluminum is under the fluxing salt. This aluminum acts as a reducing agent, removing oxygen from the salt. Sludge, which forms and which is removed once daily, floats on this aluminum, facilitating its removal. While not practical for items in bulk, it is possible to coat individual parts by lowering them into this aluminum after proper salt fluxing.

3. Aluminum Coating

Following fluxing the coating basket containing the parts is quickly placed into the pot of molten aluminum. A ceramic lined induction furnace is used since molten aluminum will attack all metals commonly used for the construction of hot-dip coating kettles. The furnace is large enough for one basket, 24 x 24 x 42 inches. (See Figure 2).

Fig. 2—Aluminum Coating Furnace.

Grade #1100 (2S) aluminum is used exclusively. This unalloyed grade is considered to offer better atmospheric corrosion protection than some of the less pure alloyed grades. The aluminum is maintained at about 1290°F.

★ ★ ★

Immersion time in the molten aluminum is usually from 1 to 3 minutes. During this time, the basket is pulled up and down several times to remove entrapped air and make sure that molten aluminum comes in contact with all surfaces. If parts are small and closely packed in the basket, they are stirred from time to time.

★ ★ ★

A coating thickness of from 2 to 2½ mils (0.002 to 0.0025 inches) is the usually specified coating thickness. Similar to other hot-dip coatings, the thickness can be controlled by immersion time, bath temperature, speed of withdrawal and subsequent treatment.

4. Removing Excess Aluminum

Excess aluminum may be removed in several ways, redipping in the fluxing bath, shaking, air blasting or centrifuging. The type product and whether it is handled by rack or basket, determine to a major extent the method used for removal. Since to a large extent the product is handled in baskets, centrifuging is the most common method. The basket may or may not be given a dip in the flux prior to centrifuging. Centrifuging times and speeds vary to meet product demands. Threads of bolts as small as 3/16 inch diameter have been cleaned with proper centrifuging. However, because of difficulties of handling such small parts, ¼ inch diameter is usually considered the lower limit for successful coating.

5 and 6. Water Quenching and Inspection

As quickly as practical after centrifuging, the parts are dumped from the coating basket into a water quench tank. Care is exercised to see that all parts fall directly into the water. The coating will be damaged should it contact the tank or other hard surface prior to being thoroughly quenched. Figure 3 shows tower bolts being dumped from a coating basket. At this stage the bolts are between 1100 and 1200°F.

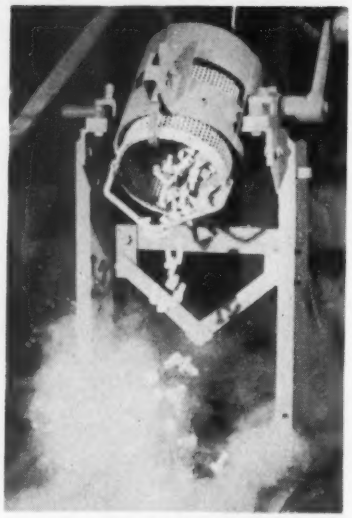

Fig. 3—Dumping Coated Bolts into Water Quench.

From the water quench tank the parts are conveyed to an inspection table. Inspection of aluminum-coated items is readily accomplished. A good coating exhibits a uniform continuous light silver-gray color, not unlike a new hot-dip zinc coating. Should the iron-aluminum bonding layer of the coating show, it will appear as a dark gray color. Black spots indicate the absence on any coating whatsoever.

7. Chemical Dip for Identification

It is very difficult to distinguish between aluminum-coated items and newly galvanized parts. To avoid the possibility of misidentification, aluminum parts may be given a chemical coloring treatment. This consists of tumbling the coated parts for about three minutes in a propietary chromate-phosphate solution maintained at 120°F. A tri-valent chromate of light green color is imparted to the product. This color is chemically combined with the aluminum coating and will not rub off nor fade in sunlight.

★ ★ ★

Of course, the aluminum coat-

ing, similar to solid aluminum, can be anodized and dyed any color desired. This process is costly as it involves electroplating and a good many of the colors are not light fast.

Product

Figure 4 shows some of the wide variety of products that are coated in the manner described. Castings, forgings, formed sheet-metal parts as well as cold and hot-produced fasteners are coated as routine. On occasion, most of the common carbon steel grades have been aluminum coated, as well as a number of alloy and stainless steels and several of the super alloys.

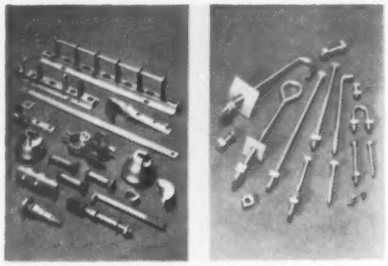

Fig. 4—Aluminum Coated Products.

The aluminum coating has an overlay of aluminum and an iron-aluminum alloy bonding layer. Figure 5 is a photomicrograph at 250 magnification through a typical coating.

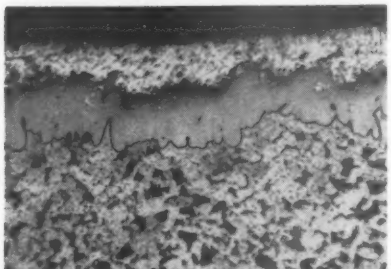

Fig. 5—Photomicrograph of Typical Aluminum Coating—250 X.

One early criticism of aluminum coatings was the lack of uniformity and concentricity. Numerous studies of batch coated products have shown excellent uniformity and concentricity. A magnified view of the cross-section of a 5/8 inch diameter aluminum-coated bolt is shown in Figure 6. The coating is uniform both at the roots and crests of the threads. Threads are unusually clean and

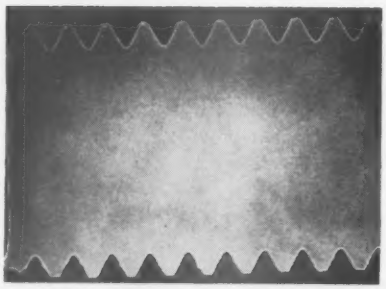

Fig. 6—Cross Section through a ⅝" Diam. Aluminum Coated Bolt.

sharp for a hot-dip coating. This is attributed mainly to the lack of dross in the molten bath. Nuts for aluminum-coated bolts are tapped only from 0.010 to 0.015 inch oversizes, about one-half that required for galvanized products, even though the two types of coatings are of equal thicknesses.

Atmospheric Corrosion—Resistance

Why an aluminum coating of steel? Because such a coating offers superior corrosion resistance in contaminated atmospheres and at elevated temperatures. Unfortunately, since most commercial aluminum coatings have only been on the market for a few years, atmospheric corrosion test data is by no means complete. However, the American Society for Testing Materials, a farsighted organization, a number of years ago established test sites to compare aluminum and zinc coatings. A study of this data is summarized in the bar graphs shown in Figure 7. All the zinc data is converted to

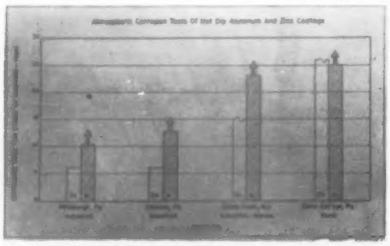

Fig. 7—ASTM Corrosion Data.

a coating weight of 2 ounces per square foot of surface area (0.0034 inch). In no case are the aluminum coatings thicker and in most instances they are considerably thinner.

★ ★ ★

At the two industrial locations the zinc-coated hardware samples were 100% rusted in about six years. At the completion of the test, about 10 years at Pittsburgh and 13 years at Altoona, the aluminum-coated samples showed no rusting as indicated by the upward arrow. At Sandy Hook, the zinc specimens were nearly 100% rusted at 15 years, indicated by wavy line, whereas the aluminum coatings showed no rusting after 23 years. In a rural area, State College, now University Park, Pa., the aluminum coatings were intact after 25 years while the zinc coatings were estimated to be completely rusted in 26 to 27 years.

★ ★ ★

Unfortunately, the tests were terminated before the aluminum-coated specimens rusted. Therefore, a definite comparison between the life expectancy of aluminum and zinc-coated articles cannot be made. It is apparent, however, that in industrial locations an aluminum coating will last a minimum of twice as long as a zinc coating of equal thickness. This is verified by tests conducted on wire and sheet samples in a steel plant atmosphere where aluminum coatings have a service life three times as long as comparable zinc coatings.

★ ★ ★

The results from one location of a current series of tests comparing aluminum-coated and galvanized pole line hardware items will be described. The rack of samples shown in Figure 8 is located on the roof of a boiler house in the middle of a large oil refinery. Prevailing winds carry

Fig. 8—Exposure Rack.

smoke, fumes, etc. from an adjacent sulphuric acid plant over

the rack as well as smoke and steam from the boilers which use contaminated industrial water. Also, close by are a phenol plant, an asphalt plant and a large metropolitan gas works. The photograph shows the appearance of the specimens after only two years exposure. A number of the zinc-coated articles are rusted whereas duplicate parts aluminum coated are rust free, although somewhat darkened.

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Sets of carefully weighed 2½ x 2½ inch washers were exposed with the other samples. A set of these washers was removed after two years, cleaned and reweighed to determine coating weight loss. The results obtained were: Loss of weight of aluminum coating, average 3 samples, 0.044 gms. Loss of weight of zinc coating, average 2 samples, 2.671 gms.

★ ★ ★

To put the weight losses on a comparable basis the aluminum loss is multiplied by 2.7, the ratios of the specific gravities of the two metals. Therefore, 0.044 x 2.7 = 0.119 or only 4½% the loss of the zinc coating. Similar calculations made after one year exposure produced an aluminum loss of 6.9% of that of zinc for this severe industrial location. Thus, in comparison, the weight loss of the aluminum coating appears to be diminishing with time.

★ ★ ★

At other industrial locations the one-year aluminum coating losses varied from 25 to 50% of that of zinc coatings, depending on the severity of the location. Test results at a sea coast exposure site are inconclusive. At 80 feet from the ocean the one year aluminum loss was only one-half that of zinc while at 800 feet the reverse was true.

★ ★ ★

Unlike zinc which corrodes uniformly when exposed to the atmosphere, aluminum becomes pitted. There is increasing evidence that the pits which form in an aluminum coating stop at the interface of the aluminum overlay and the iron-aluminum alloy layer. There appears to be no evidence of rusting of the base steel at a pit unless the alloy layer becomes damaged and cracked by cold drawing, bending, etc. When this occurs the base steel begins to rust and discoloration of the coating starts. However in the presence of aluminum, the corrosion product formed is tightly adherent, insoluble, practically impervious and therefore self-stopping to further rusting. There is no tendency for rusting to take place along the alloy-steel interface with subsequent flaking of the coating. Figure 9 is a photomicrograph at 250X through an aluminum coating at a pit location.

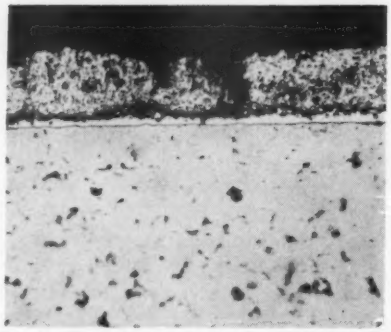


Fig. 9—Photomicrograph showing Corrosion Pit —250 X.

High-Temperature Corrosion Resistance

The ability of calorized and sprayed aluminum coatings to protect steel at elevated temperatures is well known. Hot-dip aluminum coatings also possess this characteristic.

★ ★ ★

No post treatment need be given a hot-dip aluminum coating if the part is to be subject to a constant high temperature. However, should the service be cyclic, it is preferable to give the coated part a heat diffusion treatment prior to placing it in service. The usual treatment is to heat the coated part to about 1800°F in air for 1½ to 3 hours, depending on its size. Such a treatment diffuses the aluminum overlay, resulting in a coating of all iron-aluminum alloy. An air atmosphere is recommended in order to produce a surface layer of Al_2O_3. Such a coating is highly resistant to temperature corrosion.

Up to about 1000°F, an aluminum coating is only slightly affected even after long periods of exposure. Figure 10 is a photomicrograph at 250X of a representative coating after 1000 hours exposure at 1000°F in an air furnace. Notice that the characteristic *deep scallop interface of the base steel and the iron-aluminum alloy remains. The overlay of aluminum still is apparent. A slight diffusion has taken place since the coating increased about 20% in thickness.

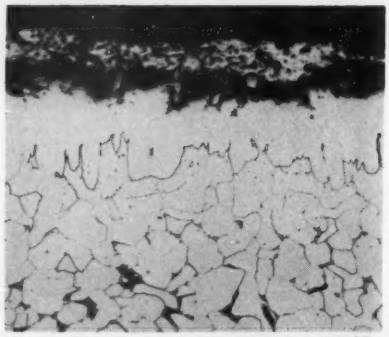


Fig. 10—Coating After 1000 Hours at 1000°F—250 X.

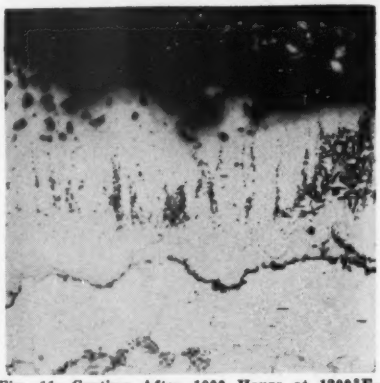
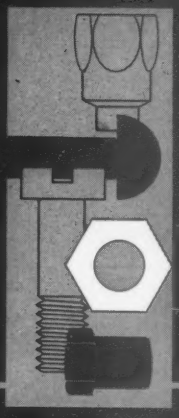


Fig. 11—Coating After 1000 Hours at 1200°F—250 X.

At temperatures above 1000°F, diffusion takes place to a greater extent. Figure 11 is a representative photomicrograph at 250X of a coating after 1000 hours at 1200°F. Here the interface is more nearly straight and no aluminum overlay remains. The coating doubled in thickness during this period of exposure. An additional 1000-hours exposure at 1200°F resulted in no further change, indicating that diffusion is rapid in

* This type interface is characteristic of Grade #1100 aluminum coatings.

(*Please turn to page* 1408)



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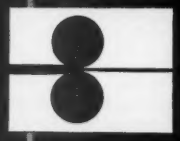

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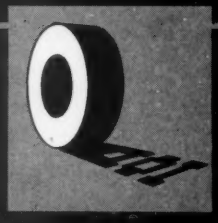

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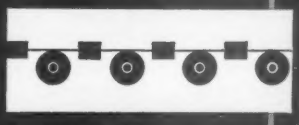

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WF-48

Aluminum Coated Steel Wire Products

by Ronald E. Griffiths
Assistant Director of Research
American Steel & Wire Division
United States Steel Corporation
Cleveland, Ohio

Introduction

Commercially available aluminum-coated steel wire products, produced by several variations of a basically hot dip method, weds the mechanical properties of steel to the corrosion resistance and decorative appeal of aluminum. Other inherent premiums include (a) heat resistance, (b) weldability, and (c) conservation of alloying elements in steel making.

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A literature search will reveal that considerable information is available regarding the various phases of aluminum coating steel.[1,2,3,4] Therefore, the contents of this paper will be confined to three topics of importance once the aluminum coated steel is processed; that is, the metallurgy of aluminum coating, its corrosion resistance and evaluation tests.

Metallurgy of Aluminum-Coated Wire Products

Once having developed a means of producing good adherent and continuous coatings at reasonable cost, indications are that aluminum-coated wires may eventually compete with almost any galvanized wire that can be named. As always, favor will trend, for any particular product, to the form having the best combination of cost of manufacture, appearance, and service durability.

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All the classes of galvanized wire products have come to be described by rigid specifications for strength and ductility, and as the latter properties are those of the steel base only, it follows that a mere substitution of aluminum for zinc will not alter the capabilities of the steel.

Ronald E. Griffiths

This paper, a part of the Symposium on Aluminizing, was presented at the Annual Convention of The Wire Association in Atlantic City, N. J., on October 13, 1958.

The author graduated from Penn State College with a degree of B.S. in Engineering and, later, an M.S. Degree in Metallurgy. He joined American Steel and Wire in 1937 as an apprentice in the Cuyahoga Works. After holding several positions, he was transferred to the American Works as a product metallurgist in 1939. In 1941 he was promoted to laboratory assistant in the Research Department and then became supervisor of the Research Laboratory. He was appointed to his present post in December, 1948. The metallurgy and corrosion resistance of hot dip aluminum coating on steel are discussed and limited evaluation tests are included, with seven references.

However, the much higher melting temperature of the aluminum does make certain added demands on the ingenuity of the metallurgist. A more exacting choice of steel base material and a more thorough understanding of all processing variables are clearly called for.

★ ★ ★

The following idealized graphs sketch the basic methods of this control. To assign specific numerical values to these relationships would lead to confusion at this time, since the infant status of aluminum coating is characterized, as other new processes have been, by the coexistence of several divergent and widely differing methods.

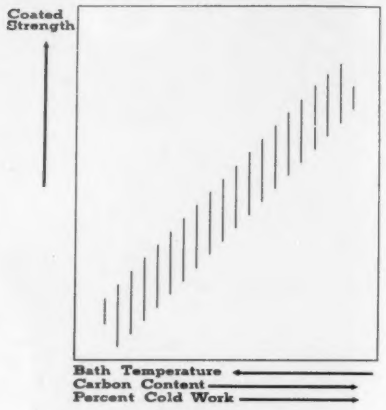

FIGURE 1

Fig. 1—Coated Strength:

The major variables here are carbon content, percent cold work, and bath temperature. Final strengths can be increased by added carbon or cold work, or by lower coating temperature. All three variables must be considered to decide on the practice which will be followed in the coating operation. With these selections, ultimate tensile strength is limited to a high of approximately 200,000 psi in the as-coated condition.

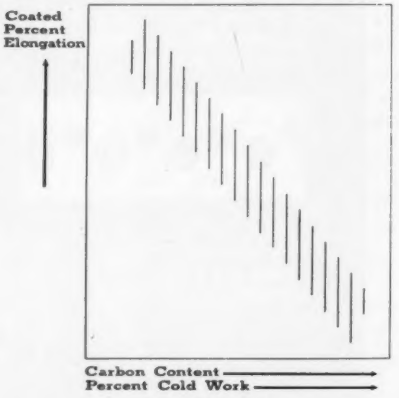

FIGURE 2

Fig. 2—Coated % Elongation:

The elongation ductility is reduced by carbon content and by degree of prior cold work. When it is necessary to meet an elongation specification, the steel chemistry and the drafting prior to coating must be carefully considered.

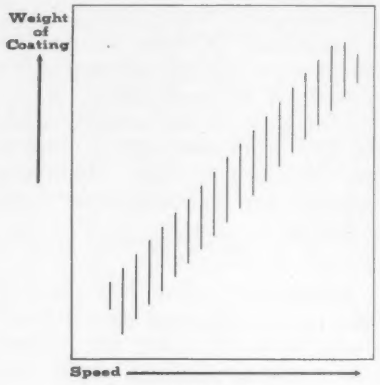

FIGURE 3

Fig. 3—Weight of Coating:

As in other hot-dip coating processes, exit speed is the principal factor.

★ ★ ★

In connection with weight of coating, there is a very important fundamental difference between zinc and aluminum. The galvanize coatings lose weight progressively in outdoor exposure. As a consequence, fairly thick layers are needed for long time protection. Aluminum coatings, in contrast, are not subject to the same type of disintegration.

★ ★ ★

It is probably very unrealistic, therefore, for potential users to demand that aluminum-coated wires compete directly with galvanized wires on a strict thickness-for-thickness basis. Given the "stay-put" virtues of the aluminum, all that is needed is the knack of putting on a **concentric** layer of no great thickness.

★ ★ ★

Fig. 4 is a photograph of such a coating, having a weight of 0.25 oz./sq. ft.

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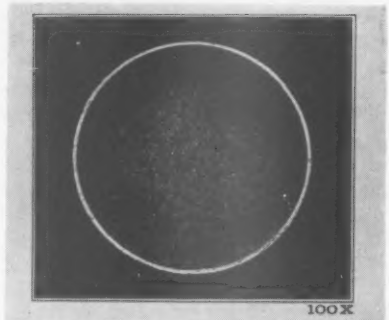
Fig. 5 shows typical aluminum coatings at higher magnification. The higher carbon content of the wire shown to the right has inhibited, to some degree, the alloy layer formation.



Photograph Showing Concentricity of Coating

FIGURE 4

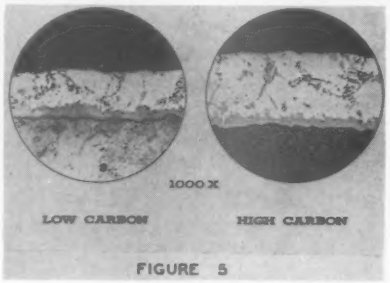


FIGURE 5

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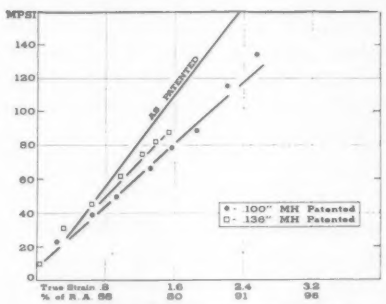
The generous proportions of wash aluminum to alloy layer characterized by these photomicrographs presages successful invasion of the metallic-coated and drawn wire field. Drawn coatings are extremely white and lustrous. In the low carbon wire products, considerable wire has already been supplied for ornamental hardware. High strength, drawn-after wires have been made experimentally for possible spring and rope wire applications. In this connection, the development of high strengths by drawing is of interest.



TENSILE PICK-UP CHARACTERISTICS IN DRAWING ALUMINUM COATED C1085 WIRE

FIGURE 6

Fig. 6—Tensile Pickup. * * * *

The structure of patented high carbon steel wire is altered somewhat by aluminum coating. This results in a slightly lower starting strength and a lower rate of strength increase with cold work. Good strength and ductility can be realized by raising the carbon level in the steel.

Corrosion Resistance

Investigators are not in complete agreement regarding the electro-chemical relationship of aluminum to steel in aluminum-coated steel. (5) (6) However, for practical purposes, aluminum is classified cathodic to steel as long as its oxide film remains intact. When cathodic to steel, the aluminum coating will not protect cut ends or voids and breaks in the coating. However the aluminum coating will and does inhibit undercutting.

★ ★ ★

To date, the most vivid demonstration of this ability to inhibit undercutting has been noted on wire products where cut ends are a natural result of fabrication, as for example, in the manufacture of barbed wire. When fabricating barbed wire from aluminum-coated wire the cut ends of the barbs will show a small area of bare steel, in spite of the tendency of aluminum to swedge in the cutting operation. When exposed the bare steel will rust immediately. This rusting does not progress, as evidenced by the continued sharpness of aluminum-coated barbs after almost six years' exposure in the industrial atmosphere of Cleveland.

★ ★ ★

When the oxide film of the aluminum coating degrades, the aluminum becomes less cathodic and more anodic to steel. One investigator postulates that this change in the electro-chemical behavior of the aluminum coating inhibits or suppresses further corrosion of the steel base at coating discontinuities in rural or industrial atmospheres.

★ ★ ★

In a marine atmosphere the oxide film of aluminum is destroyed by the prevailing chloride con-

taminants, rendering the aluminum active and anodic to steel. Under these conditions some cathodic protection of the steel may be expected at scratches, voids and cut ends of limited width.

★ ★ ★

A greater weight loss may be anticipated in a marine service, attributable to the loss in passivity of the aluminum coating and the consequential cathodic protection of steel. This increased weight loss can reduce, to a certain degree, the margin of superiority in service life which aluminum-coated steel will display against other commercial steel finishes. Despite this reduction, the superiority of aluminum-coated steel is still definitive. Additional improvements in marine service may be realized by an increase in coating weight and/or chemical treatment.

Accelerated Corrosion Testing

The corrosion resistance of any material is governed by the environment to which it is subjected and the composition of the material. Any variation in these two governing factors, large or small, may, and often does, change the relative corrodibility of the material.

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It follows, therefore, that no accelerated corrosion test, including the well-known and widely used salt spray and humidity tests, will predict with any degree of reliability the anticipated life of a product, or its rating with respect to an alternate material. This statement applies even to those atmospheres which the accelerated tests are supposedly simulating. In view of these limitations the evaluation of aluminum-coated steel by any of the accelerated tests devised to date is not advocated or recommended.

Atmospheric Corrosion Testing

We do advocate and practice establishing the relative corrosion resistance of both experimental and commercial finishes by service exposures in atmospheres typical of those most commonly encountered. True, this practice is more costly and time-consuming than resorting to accelerated corrosion tests, but the accuracy of the information is its own reward both to the researcher and to the manufacturer.

★ ★ ★

Our corrosion samples are exposed in atmospheric test lots at several geographic locations. These test sites are situated at Kure Beach, N. C., by courtesy of International Nickel Co., Inc., at Newark, N. J.; South Bend, Pa., and at Cleveland, Ohio. Views of typical test lots are shown in Figs. 7 and 8.

FIGURE 7

FIGURE 8

The relative corrosivity of these atmospheric test lots is established by calibrating with steel and zinc panels of standard size and composition.[7] Since two of the four test sites, namely the Newark and Cleveland locations, were established recently, there is a scarcity of comparative calibration data. Limited data are presented in Table I.

★ ★ ★

Table I

CALIBRATION OF ATMOSPHERIC TEST LOTS

Location	Period	Average Weight Loss —grams/48 sq. in./yr. Steel	Zinc
		Industrial	
Cleveland, O.	'55-'56	24.1	—
	'57-'58	15.9*	0.45
Newark, N. J.	—	—	—
		Marine	
Kure Beach, N. C.	'54-'55	108.0	1.96
80-ft. lot	'55-'56	103.0	1.45
800-ft. lot	'54-'55	12.7	0.55
	'55-'56	22.3	0.75
		Semi-rural	
South Bend, Pa.	'54-'55	9.0	0.35
	'55-'56	10.8	0.53

* Spring exposure—all other calibrations were fall exposures.

According to these values the most severe exposure station is the 80-foot lot at Kure Beach, N. C., and the least severe is South Bend, Pa. The other sites are intermediate. Experience with aluminum coatings may eventually alter these ratings.

★ ★ ★

Aluminum coating will successfully protect the steel base in most atmospheres provided the aluminum coating displays three important characteristics.

1. The Fe-A1 alloy layer and the aluminum layer must be continuous and of reasonably uniform thickness.
2. If the aluminum-coated steel wire is subjected to fabrication after coating, the cracking and damage to the alloy or aluminum layers must be kept to a minimum.
3. The ratio of the thickness of the alloy layer to the residual aluminum layer must favor a thin Fe-A1 alloy and a heavy aluminum layer.

★ ★ ★

In a marine atmosphere aluminum-coated steel will outperform conventional galvanized steel. Fig. 9 summarizes the performance to date of aluminum-coated and galvanized Amerstrand exposed at Kure Beach, N. C. since 1953.

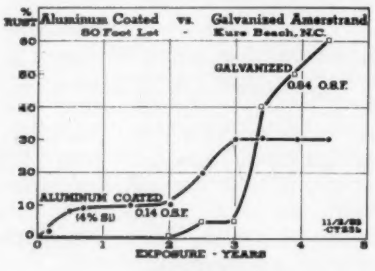

FIGURE 9

In the 80-foot lot the galvanized item has rusted more extensively than the corresponding aluminum-coated sample. These tests are being continued to establish an ultimate life figure for the aluminum-coated steel.

★ ★ ★

Steel with an aluminum coating

will continue to maintain its superiority over its most important rival, the galvanized finish, in other environments. Fig. 10 depicts graphically the performance of galvanized and aluminum-coated field fence at the Cleveland industrial test site.

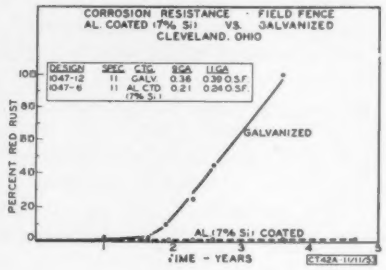
CORROSION RESISTANCE - FIELD FENCE
AL. COATED (7% Si) VS. GALVANIZED
CLEVELAND, OHIO
DESIGN SPEC. CTG. BGA LGA
1047-12 11 CALV. 0.36 0.30 O.S.F.
1047-6 11 AL. CTD (7% Si) 0.21 0.24 O.S.F.
PERCENT RED RUST
GALVANIZED
AL. (7% Si) COATED
TIME - YEARS

FIGURE 10

In this exposure the life of the galvanized product was approximately 3.5 years. The aluminum-coated field fence has been exposed for almost five years and has rusted to a very slight extent. The rusting is a pitting type of corrosion, scattered over approximately 1% of the surface.

★ ★ ★

Even in a relatively mild environment the protection afforded by a commercial galvanized finish is inferior to an aluminum-coated surface. For example, consider the corrosion resistance of barbed wire, galvanized and aluminum coated, in a semi-rural atmosphere summarized in Fig. 11. Performance of these same items in the Cleveland industrial test lot is cited for comparative purposes.

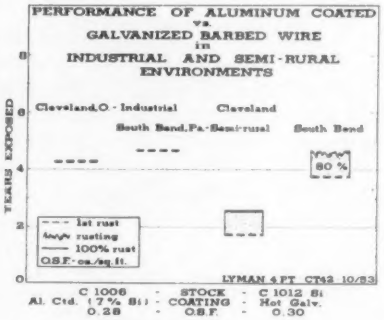

FIGURE 11

Extended Service Testing

We supplement and confirm the information obtained in our several atmospheric test lots by actively participating in cooperative exposure programs with potential customers. For example, in 1953 approximately fifty installations of barbed wire and field fence were completed in 18 of the 49 states. These installations involved both privately owned properties and state experimental agricultural stations.

★ ★ ★

Several of these installations were inspected after approximately four years' service. The reports show that the aluminum-coated products had developed some discoloration (patina) which varied in intensity with the severity of the environment. The cut ends had rusted, but no undercutting was observed. An occasional wrap had corroded to a certain extent. At those installations where Type I galvanized products were also erected, for comparative purposes, the galvanized materials were rusting, sometimes extensively.

★ ★ ★

Aluminum is not self-cleaning. Thus, to the uninitiated, the early development of patina is often misleading and is interpreted as premature failure. To combat this misinterpretation, an extensive educational program is needed.

Table II

EVALUATION TESTS FOR ALUMINUM-COATED STEEL WIRE

Purpose	Test	Description	Units
Ductility	"Button" Helical Wrap	Wrap wire around own diameter or multiples thereof	Multiples of dia. (d) without cracking or spalling
Uniformity Thickness	Metallographic Examination	Cross-sectional Longitudinal	—
	Wittrock	Immerse in sulfuric acid solution containing Cu and F ions repeatedly until alloy or base metal is exposed.	Minutes to failure adherent copper
Continuity	Nitric Acid	Immerse in 35% HNO_3 at room temperature and note gas evolution.	Qualitative Quantitative*
Wt. of Coating	ASTM A 428-58T	Strip in 20% NaOH. Rinse and scrub. Dip in conc. HCl and rinse. Repeat this cycle until gassing ceases in caustic.	oz./sq. ft.
Coating Analysis	U. S. Steel Corp. Analytical Chem. method for al. ctgs. on steel.	Strip one-half of ctg. with NaOH. Analyze stripping solution for Si, Fe, and other elements desired.	% by weight

* To be quantitative the sample size, immersion time and temperature must be standardized.

Miscellaneous Evaluation Tests

Several evaluation tests have been designed in the course of aluminum-coated steel development for purposes of gradation. The test details are summarized in Table II.

★ ★ ★

Comments on these tests will be restricted to an observation that there is insufficient information available to predict the acceptability of these tests for reproducibility between laboratories or repeatability within a sample lot. Establishing the reliability of these and other evaluation tests for specification purposes is a fruitful field for future endeavor.

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Alumoweld Wire
A New Aluminum Coated Steel Wire With a Thick Coating

by Leslie C. Whitney
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Copperweld Steel Company
Glassport, Pennsylvania

Thirty years ago, the only type of wire considered to be fully satisfactory for the transmission and distribution of electrical energy was copper. While copper possesses excellent electrical and corrosion resistant properties, its major limitation for overhead lines is its lack of strength. In the hard-drawn condition, the maximum strength obtainable is about 65,000 pounds per square inch. In mountainous terrain or for river crossings where long spans are required, the wind and ice loads developed under storm conditions are often sufficient to cause breakage of the wire and interruption of electrical service. In addition to this, a very large factor in the cost of any electrical line lies in the number of poles and towers required and so, from an economic point of view, long spans are desirable.

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To meet this problem of strength, copper-covered steel—known as Copperweld— was developed in 1915. It is produced by casting molten copper around a heated steel bar, hot rolling the composite material to a ⅜ inch rod, heat treating the rod and cold drawing it to the desired wire size.

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At the close of World War II, copper wire was still difficult to obtain. Aluminum, however, was available in greater quantities than ever before and at a price lower than that of copper. Its electrical conductivity is, however, only about 60% of that of copper with the result that the wire size must be increased to secure the same conductance characteristics. This is more than offset by the fact that its weight per unit volume is only about one-third that of copper. Under these favorable economic conditions, the use of aluminum wire for electrical purposes has increased rapidly in recent years and has exceeded the demand for copper wire for overhead lines.

Leslie C. Whitney

The author graduated from Lehigh University in 1922 with a degree of Metallurgical Engineer. From 1922 to 1930 he was with the American Steel and Wire Company in Worcester, Mass., as Assistant Head of the Physical Laboratory. In 1930 he joined Copperweld Steel Company and was Chief Metallurgist until 1954, when he was made Manager of Development Engineering.

This paper was presented as a part of the Symposium on Aluminizing at the Annual Convention of The Wire Association in Atlantic City, N. J., on October 13, 1958.

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While aluminum wire became acceptable to the utility industry and could compete economically with copper, it is subject to an even more serious strength limitation than is copper. The maximum strength that can be developed in the EC grade of aluminum is about 30,000 pounds per square inch. To overcome this, the ACSR type of strand was developed which incorporated galvanized steel wire in the core to increase its strength. This type of strand has received wide acceptance.

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There still remained a need for increased strength in the individual aluminum wires and for an ACSR core wire having a corrosion resistance compatible with that of aluminum. With Copperweld's experience in the production of bimetallic wires, it was only natural that the Company should consider the various methods by which this might be accomplished.

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The standard method for the production of Copperweld rods was obviously unsuited because of (1) the impossibility of hot rolling the steel core at a temperature below the melting point of aluminum and (2) the formation of a hard, brittle aluminum-iron alloy constituent at the interface which would have reduced the conductance and caused difficulty in cold working.

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The problem, therefore, resolved itself into (1) the application of an aluminum coating of sufficient thickness to obtain a suitable electrical conductivity and corrosion resistance in the finished wire, (2) the production of a suitable

bond between the aluminum coating and the steel base without the formation of a brittle aluminum-iron alloy constituent between the two metals and (3) the selection of the proper type of steel which could be drawn sufficiently to produce the required strengths.

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Consideration was given to the various methods by which the first of these conditions could be met. The thickness of the coating required was considerably greater than could be obtained by a hot dip process. Extrusion of the aluminum on to the steel rod was a possibility but such attempts did not develop a bond and resulted in the formation of a loose tube on the steel rod. On drawing, the steel rod acted as a mandrel so that the thickness of the coating was reduced on each draft without any appreciable reduction of the steel core. Another possibility was the electrodeposition of aluminum on steel but the solutions and practices required for this are very complicated and subject to the production of unsatisfactory coatings unless closely controlled. Having ruled out each of the above methods, the one method which appeared to hold promise was that of powder metallurgy. This involves the application of a suitable metallic powder to the base metal and compacting it with heat so that a solid coating is formed without its being melted.

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Research along these lines was carried out at Battelle Memorial Institute in Columbus, Ohio. Preliminary experiments were made on short lengths to evaluate the various types of powder available and to develop suitable practices for the production of a dense coating of aluminum on the steel rod without the formation of a brittle alloy constituent at the interface. In studying this problem, numerous metallographic investigations were made and in addition to this an electron-probe analyzer was used to measure the composition of the metal across the interface. This latter type of examination was made by traversing the interface in small increments, starting in the steel area and crossing into the aluminum area. At each increment, the intensity of the x-rays emitted by the iron indicated the composition of the metal at that point. In Figure No. 1, we have shown an aluminum coated steel rod in which a brittle iron-aluminum intermetallic compound was present at the interface. The flat plateau of the data obtained by the electron-probe analyzer showed that this compound had an iron content of 29 percent. In contrast with this is Figure No. 2 in which a similar examination was made on an Alumoweld rod. In this sample, there was no brittle compound at the interface but only sufficient diffusion between the two metals to insure a bond.

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Having obtained sufficiently encouraging results in our preliminary work, a pilot plant for continuous production was erected at Columbus. In this, the steel rod is fed from a flipper through a straightener and then into a cleaner. The aluminum powder is applied to the rod and the composite rod is then subjected to heat and pressure to form a solid aluminum coating on the steel core. A schematic drawing of this process is shown in Figure No. 3 and the uniform coating developed on Alumoweld wire has been illustrated in Figure No. 4. In the early stages, this pilot plant was under the direction and supervision of Battelle but it is now being operated on a commercial scale by Copperweld personnel.

★ ★ ★

The engineering of such a plant and its operation have created many new and unusual problems. With the efficient assistance of the staff at Battelle, the details have been solved satisfactorily and applications for patents have been made. Since patents are still pending, I am not at liberty to discuss the details of the equipment or of the process at this time.

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From our experience thus far, it appears possible to apply coatings in a wide range of thicknesses. To make the best use of the production facilities, however, it has been decided to concentrate on coatings similar to those on our standard Copperweld wire which have been found especially applicable to the transmission and distribution of electrical energy. Based on this, we are producing a wire with a permanently bonded coating of aluminum that constitutes 25% of the cross sectional area of the wire and has a guaran-

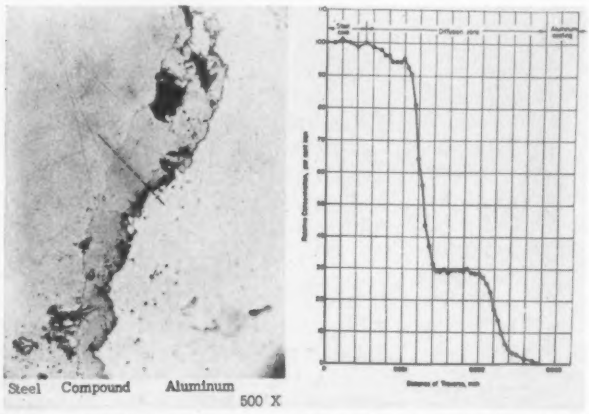

Figure 1. Distribution of iron across the interface of an aluminum coated steel rod containing visible evidence of an iron-aluminum compound.

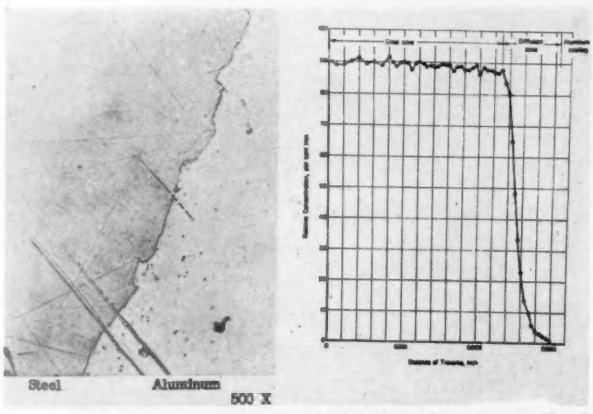

Figure 2. Distribution of iron across the interface of an Alumoweld rod free from visible evidence of an iron-aluminum compound.

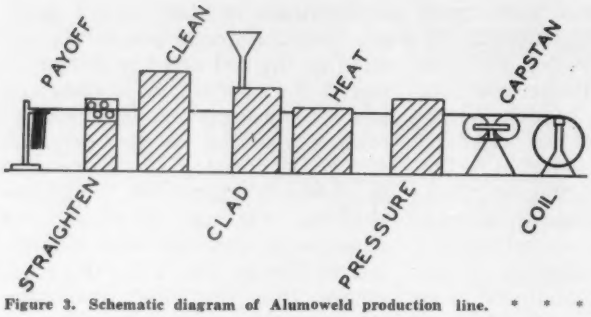

Figure 3. Schematic diagram of Alumoweld production line. * * *

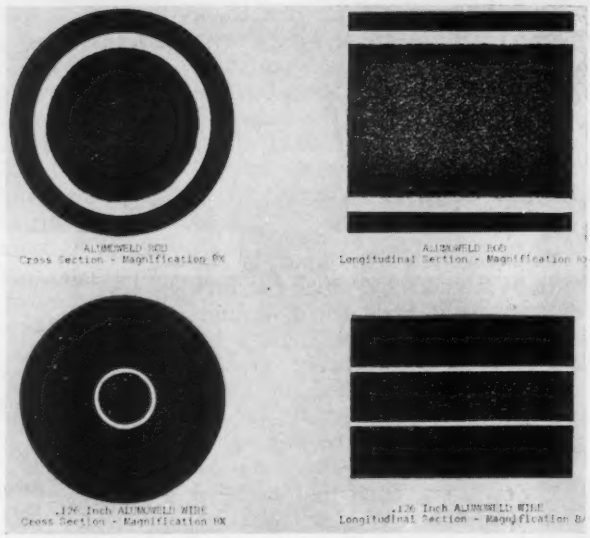

Figure 4. Cross and longitudinal sections of Alumoweld rod and wire showing the uniform distribution of aluminum around the steel core. *

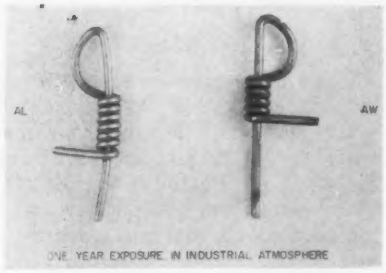

Figure 5. Aluminum and Alumoweld wires after being exposed for one year in an industrial atmosphere. * * * * * * * * * *

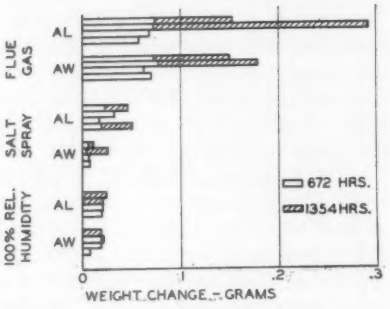

Figure 6. Results of accelerated corrosion tests on solid aluminum and on Alumoweld wires. *

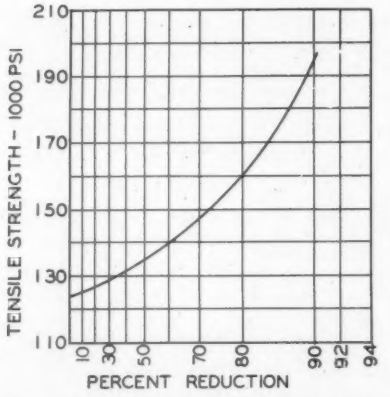

Figure 7. Increase in tensile strength on drawing Alumoweld wire. * * * * * * * *

teed minimum thickness of 10% of the wire radius. Such a wire has a D.C. electrical conductance of 33%—or, in other words, one-third that of a solid aluminum wire of the same diameter. The steel core has been selected so that tensile strengths in the hard-drawn bimetallic wires can exceed six times the maximum that can be developed in the EC grade of aluminum wire.

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Having produced this wire, the next step was to determine how it compared under service conditions with EC grade of aluminum wire. Atmospheric corrosion tests were set up under industrial, marine and rural conditions and are continuing. The samples of wire and strand have shown no signs of deterioration but the exposure period will have to be extended for several years before any valid conclusions can be drawn. Figure No. 5 shows both aluminum and Alumoweld samples to be practically unaffected after being exposed for one year in an industrial atmosphere. To obtain such information more quickly, we have conducted accelerated corrosion studies based on the following accepted methods:

1. **Salt spray, ASTM method, 20% NaCl at 95°F.**
2. **100% relative humidity at 100°F.**
3. **Continuous condensation in flue gas with 25 grains of sulphur per 100 cu. ft. added as SO_2.**

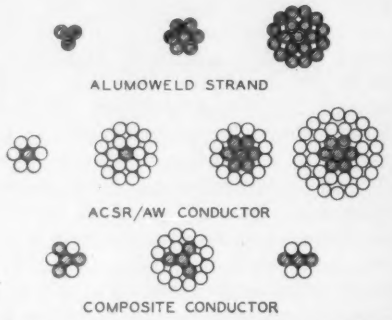

Figure 8. Variations in composite aluminum-Alumoweld strand. * * * * * * *

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Sample lengths of EC grade aluminum wire and Alumoweld wire were wrapped around their own diameters and exposed to the tests for a period of 8 weeks, the equivalent of many years of service. The results as shown in Figure No. 6 indicate that in every case the corrosion resistance of the Alumoweld wires was equivalent to that of the EC grade of solid aluminum wires.

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Alumoweld wire can be drawn to high strengths as shown in Figure 7 and has a very high strength to weight ratio. The combination of low weight and high strength

(*Please turn to page* 1413)

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ELECTRIC WIRE & CABLE SECTION NEWS

At its meeting on October 13, 1958, the Board of Directors of The Wire Association authorized the Section to hold a technical session in the Spring of 1959.

During the Annual Convention in Atlantic City, N. J., the Electric Wire and Cable Section Committee held a meeting at which Boston, Massachusetts, was decided upon as a desirable location for the meeting.

Urbain J. H. Malo, Technical Director, The Crescent Co., Pawtucket, R. I., was appointed Program Chairman, and the Statler Hotel, Boston, on April 23-24, 1959, has been tentatively decided upon as the time and place.

The Committee

Since the last publication of the committee membership, one resignation has been received and one addition made. The complete list of members is as follows:

Clement C. Lawson (Chairman)
Plant Facilities Engineer
Bell Telephone Laboratories, Inc.
Murray Hill, N. J.

Harold W. Adams, Prod. Supvr.
Cable Div. Reynolds Metals Co.
6601 W. Broad St.
Richmond, Va.

David Barr, Plant Eng.
National Electric Products Corp.
338 14th Street
Ambridge, Pa.

Grover W. Brown, Mgr., Machinery Development
The Okonite Co.
Passaic, N. J.

G. E. Forsberg, Vice-President
Surprenant Manufacturing Co.
172 Sterling St.
Clinton, Mass.

Charles M. Fredrickson, Tech. Dir.
Southern Electrical Corp.
P. O. Box 989, Chattanooga, Tenn.

James S. Higgins, Plant Eng.
Walker Brothers,
Copper Div.
Conshohocken, Pa.

R. W. Higginbottom, Chief Cable Eng.
Triangle Conduit & Cable Co.
P. O. Box 711
New Brunswick, N. J.

Alexander A. Kerr, Supt.—Prodn.
Electrical Wire Div.
John A. Roebling's Sons Corp.
Trenton 2, N. J.

C. L. Kessler, Chf. Works Met.
Aluminum Company of America
P.O. Box 150, Massena, N. Y.

Alfred H. MacGillivray, Supt.
Collyer Insulated Wire Co.
249 Roosevelt Ave.
Pawtucket, R. I.

Urbain J. H. Malo, Technical Dir.
The Crescent Co., Inc.
Front & Central Ave.
Pawtucket, R. I.

W. R. Moyers, Chief Eng.
Wire Engineering Dept.
Western Electric Co.
P. O. Station B
Buffalo 7, N. Y.

J. C. Murray, Jr., Vice-President
Crescent Insulated Wire & Cable Co.
319 N. Olden Ave.
Trenton 5, N. J.

D. M. Schmid, President
Techalloy Co., Inc.
Rahns, Pa.

Philip H. Snyder, Plant Mgr.
Wire and Cable Div.
The Electric Auto-Lite Co.
601 Poplar St.
Hazelton, Pa.

H. S. Spaulding, Tech. Supt.
Kaiser Aluminum & Chemical Corp.
P. O. Box 671, Newark, Ohio

Roger T. Stafford, Project Engineer
Kennecott Wire & Cable Co.
Phillipsdale (Rumford 16), R. I.

Marshall V. Yokelson, Res. Met.
General Cable Corp.
Bayonne, N. J.

Further details will be reported as they develop.

THE WIRE ASSOCIATION

RICHARD E. BROWN, *Executive Secretary*

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Resistance to Corrosion of Aluminum Coated Steel Wire

E. T. Englehart
Chemical Metallurgy Division

by
and

K. J. Brondyke, Asst. Chf.
Fabricating Metallurgy Division

Alcoa Research Laboratories
Aluminum Company of America
New Kensington, Pennsylvania

E. T. Englehart

This paper was presented as a part of the Symposuim on Aluminizing at the Annual Convention of The Wire Association in Atlantic City, N. J., on October 13, 1958.

Mr. Englehart has been employed at the Alcoa Research Laboratories since graduating from Pennsylvania State University in 1943 with a B.S. in Chemistry. His work has been associated with fundamental and practical problems of corrosion of aluminum alloys as well as the study of methods of preventing corrosion. He is the author of several papers dealing with corrosion problems of aluminum alloys. He is a member of N.A.C.E.

Mr. Brondyke has been employed at Alcoa Research Laboratories since graduation from the University of Michigan in 1948 with a B.S. in Metallurgical Engineering. His work has been associated with metallurgical processes as applied to aluminum and its alloys. Mr. Brondyke is a member of ASM and RESA.

K. J. Brondyke

Hot dipped aluminum coated steel has a long history, beginning in the latter part of the 19th century. The first public record is the patent issued to Mr. E. C. Broadwell in 1893.[1] Then, as now, the possibilities of combining the excellent corrosion resistance of aluminum with the strength of steel were recognized. In these early processes, dip coatings were applied after precoating the steel with zinc, lead, or tin. Coatings at that time were applied almost exclusively to sheet and plate. The processes were unsatisfactory for commercial application because of excessive contamination of the aluminum coating bath by the precoating metal. Aluminum dip coating technology has developed where metal precoating is no longer necessary.

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Alcoa has been actively interested in aluminum coating of steel from the outset, working closely over the years with numerous companies on process development and product evaluation. First samples examined by Alcoa were received in 1907. Aluminum dip coating of sheet, plate, and rivets was conducted at Alcoa Research Laboratories as early as 1932. Our interest in applying aluminum coated steel wire to ACSR prompted the installation of a pilot coating line in 1947. Knowledge gained from these investigations has been made available to all those interested in hot dip aluminum coating applications. Some of these experiences were covered in the paper, "Aluminum Coating of Steel—A Comparison of Various Processes," by P. T. Stroup and G. A. Purdy.[2]

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Hot dip aluminum coating of sheet was developed to a commercial scale by Armco Steel Corporation in 1946. The Armco process involves pretreating the steel in a controlled atmosphere before immersion in the aluminum bath.[3][4] Although the development of an aluminum coating process for wire was initiated as early as 1936,[5] it was only within the past few years that hot dip aluminized iron and steel wire was made commercially available. Aluminum coated steel wire has applications as fencing, wire cloth, telephone carrier, and guy wires. High strength aluminum coated wire is being used by Alcoa for application as core wire in aluminum electrical transmission cable (ACSR).

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From an operating standpoint, hot dip aluminizing of wire is similar to hot dip galvanizing, which includes surface cleaning, fluxing and dipping. Each of these operations is performed in succession as the wire is drawn through the coating line. As in galvanizing, multiple wires are coated simultaneously.

Cleaning

Cleanliness of the wire surface is essential to the production of an aluminum coating free from holidays, for aluminum will not bridge over residuals on the wire. This includes complete removal of lime, drawing soaps, dirt, and/or oxide. Cleaning wire involves a preheat

under controlled conditions followed by an acid pickle in either hot hydrochloric acid or hot sulfuric acid. The wire is then thoroughly rinsed in hot, then cold water to remove residual iron salts.

Fluxing

After cleaning, the aluminum coating may be applied either in a controlled atmosphere,[6] by using a molten salt flux, or using a water solution flux. The atmosphere, or fluxes, prevent reoxidation of the wire and promote wetting of the steel by the aluminum. One company is using a water solution flux.[7] A water soluble flux containing fluoride and bromide salts was developed and patented by Alcoa.[8] This flux, developed specifically for wire, is used under conditions familiar to galvanizers. The water base flux is maintained around 180° F for best reactivity. When fluxed at this temperature, the wire possesses sufficient heat capacity so that it is rapidly dried before immersion in the aluminum coating bath. A typical molten salt flux is maintained around 1300°F.

Coating

Aluminum coating is applied by drawing the wire through the bath under a suitable sinker roll. Vertical withdrawal is necessary to produce a coating of uniform thickness. Even withdrawal with minimum vibration is an essential of smooth uniform coatings. Coating concentricity is a problem, particularly with thicker coatings. Special techniques developed by various coaters have virtually overcome this difficulty. Typical hot dip aluminum coated steel wire has a surface layer of cast aluminum and an iron-aluminum interfacial layer (Figure 1). In hot dip aluminum coating of wire it is desirable to produce a heavy, 2 to 3 mil, aluminum layer, yet hold the brittle iron-aluminum interfacial layer to a minimum thickness in order to permit bending and forming. Coating acceptability is dependent on the diameter wrap test, in which the coating must not fracture when the wire is wrapped around a mandrel whose diameter is either equal to, or twice that of the wire. Coating thickness is related to wire diameter and speed of travel through the bath.

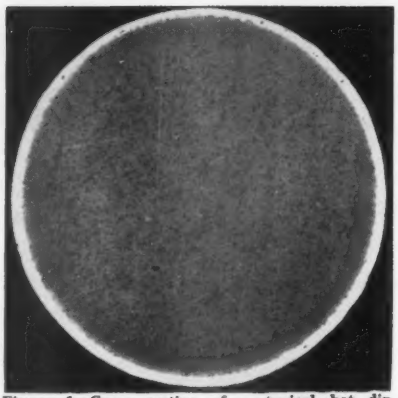

Figure 1—Cross section of a typical hot dip aluminum coated steel core wire for ACSR showing the aluminum coating and aluminum-iron alloy layer. The wire was normally 0.066" in diameter, the aluminum coating averaged 0.0018" in thickness and the alloy layer was 0.00028" thick (magnification—50x).

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Although interfacial layer thickness is dependent on bath temperature and time of immersion (length of travel and wire speed), the most effective means of control is by addition of silicon to the aluminum coating bath. There is a rapid decrease in the thickness of the interfacial layer as the silicon content increases up to about 2.5 per cent. A smaller decrease occurs as the silicon content is further increased.[2] Silicon additions have little effect on either resistance to corrosion or physical properties. Beryllium may also be used to control iron-aluminum layer thickness,[9] but the toxicity of its fumes should always be considered in any commercial application. In a typical wire coating operation, the aluminum bath temperature is maintained in a temperature range of 1250 to 1300°F.

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In applying aluminum coating to wire products, it is desirable to produce a uniform coating of sufficient thickness to obtain the desired protection. As described above, wire speed, stability of the coating equipment, and method of withdrawal from the aluminum all contribute to coating appearance. Iron contamination in the aluminum bath may cause rough coatings. In continuous aluminum coating of wire, iron content will gradually increase to about 1.5 per cent when a sludge is formed. Usually this sludge settles out, permitting its removal by raking off the bottom. Any agitation of the aluminum bath, however, will cause the sludge to be suspended in the bath, leading to coating roughness.

Mechanism of Protection

There have been many discussions in the past concerning the mechanism of protection of steel wire by hot dip aluminum coatings. Some have said that this protection is electrochemical in nature while others have indicated that the aluminum coating affords only blanket protection to the underlying steel. Experience at Alcoa Research Laboratories has indicated that the mechanism of protection of this product is a combination of both electrochemical reaction between the aluminum and steel and the covering effects of the aluminum coating.

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Commercial aluminum has a solution potential of -0.83 volts when measured in a neutral chloride solution against a 0.1 normal calomel electrode, while steel under similar conditions has a solution potential of -0.67 volts. Thus, under conditions where chlorides are present, a potential difference of 0.16 volts exists between aluminum and steel. This difference in solution potential varies according to the electrolyte to which the materials are exposed. In some sulfate solutions, there is practically no difference in solution potential between aluminum and steel. Considering these differences in solution potential, it is apparent that the aluminum coating on steel should provide better electrochemical protection in some environments than in others. Such has been found to be the case. In all cases examined, evidence of at least some electrochemical protection has been found regardless of the enviroment to which the aluminum coated steel was exposed.

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In addition to the effects of various electrolytes on the amount of electrochemical protection afforded

steel by aluminum, there is the natural variation in environments to which the product may be exposed. As stated above, there can be a wide variation in performance between atmospheres containing chlorides and those containing sulfates. Other environments containing insignificant amounts of any of these salts, are unpolluted and perform still differently. The amount of protection afforded to steel by aluminum depends not only on the type of salts present, but also on the conductivity of the electrolyte present on the product. Naturally for good electrochemical protection to occur, there must be electrolytes present to carry the small corrosion currents from the aluminum to the steel member. Under conditions in which a good electrolyte does not exist, any protection of the steel by the aluminum would be largely only of a blanket nature.

* * *

Another factor which must be considered is the distance over which the aluminum will provide electrochemical protection to steel. This depends not only on the type and conductivity of the electrolytes present but also on the amount of moisture available. In seawater, the aluminum will provide good electrochemical protection to steel over an extended area. However, in environments where the product is only dampened slightly by mist or dew, the extent of electrochemical protection would be expected to be small.

* * *

Considering the preceding discussion together with the good results obtained from atmospheric exposure of aluminum coated steel, it is felt that the aluminum provides electrochemical protection to steel under almost all conditions of exposure. The extent of protection, of course, is a matter of degree, with better protection obtained under conditions in which a good electrolyte is available. Blanket protection provided by aluminum to steel is also a matter of degree. Under conditions where electrochemical protection does not function efficiently, the covering effects of the aluminum coating provide protection to the underlying steel.

TABLE I

CHANGES AS A RESULT OF ATMOSPHERIC CORROSION OF COMMERCIAL ALUMINUM AND ZINC AFTER EXPOSURE OF TEN YEARS AT ASTM TEST STATIONS

	Commercial Aluminum (1100 Alloy)		Commercial Zinc (Prime Western)	
Test Station	Weight Loss grams(1)	% Change in Tensile Strength(2)	Weight Loss grams(1)	% Change in Tensile Strength(2)
Altoona, Pa.	2.26	-5	48.87	-24
New York City	3.13	-3	49.55	-23
Sandy Hook, N.J.	0.21	0	14.12	-9
Key West, Fla.	0.35	0	5.32	-5
La Jolla, Calif.	2.80	-12	18.29	-14
State College, Pa.	0.12	0	10.64	-9

NOTES:

(1) Based on 9" x 12" plate specimens

(2) Based on machined tension specimens

(3) Source - Symposium on Atmospheric Exposure Tests on Non-Ferrous Metals - Pittsburgh Spring Meeting American Socity for Testing Materials - February 27, 1946.

* * *

Because of its high solution potential, zinc, such as is used on galvanized steel, can provide better electrochemical protection than aluminum under many conditions of exposure. However, in many cases this can be a disadvantage rather than an advantage. The reason for this is that in many cases the amount of electrochemical protection provided by the aluminum is sufficient and additional amounts are not necessary. Therefore, the increased reaction of the zinc many times decreases the over-all expected life of the zinc coated steel product as compared to that of a similar aluminum coated product. An example of this is the case of core wire for ACSR, (Figure 2). Under some

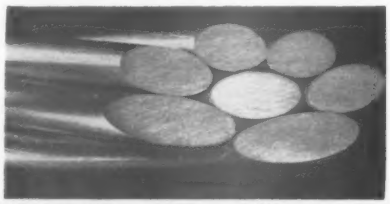

Figure 2—Cross section of ACSR (Aluminum Conductor Steel Reinforced) showing an aluminum coated steel core wire surrounded by six aluminum strands. This is one of the many types of ACSR in which hot dip aluminum coated steel wire can be used. * * * * *

conditions, the zinc on galvanized core wire will serve to electrochemically protect not only the steel core wire but also the aluminum conductor strands which need no protection. When this occurs, the zinc may be consumed, leaving the steel unprotected except for the electrochemical protection it can receive from the aluminum strands. Aluminum coated steel core wire does not have this disadvantage in that the aluminum coating and conductor strands are electrochemically neutral.

Performance Tests

In general, the inherent resistance to corrosion of aluminum base alloys is somewhat higher than that of zinc base alloys. This has been established by ASTM and other organizations. As shown in Table I, tests conducted at various ASTM test stations have demonstrated that commercial aluminum (1100 alloy) has a resistance to corrosion superior to that of commercial zinc (Prime Western) in industrial, seacoast and rural environments. With this in mind, it would appear logical to assume that aluminum coated steel should have a higher resistance to corrosion than zinc coated steel, providing that the mechanics of coating steel with aluminum could be established. However, one of the problems that arise with the development of any product, such as aluminum coated steel wire, is the determination of a method to determine if it will provide the expected satisfactory service life. Naturally the most realistic method of evaluation is by long-time exposure to natural environments. In addition, it is necessary to establish some accelerated tests that will establish the quality and uniformity of the product. Alcoa Research Laboratories have been working on the evaluation of alum-

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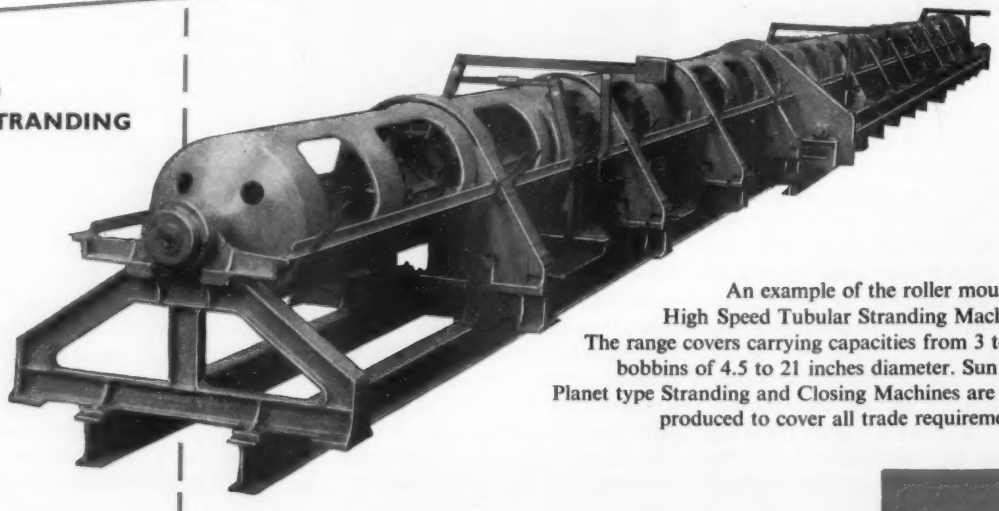
HIGH SPEED TUBULAR STRANDING MACHINE



An example of the roller mounted High Speed Tubular Stranding Machine. The range covers carrying capacities from 3 to 45 bobbins of 4.5 to 21 inches diameter. Sun and Planet type Stranding and Closing Machines are also produced to cover all trade requirements.

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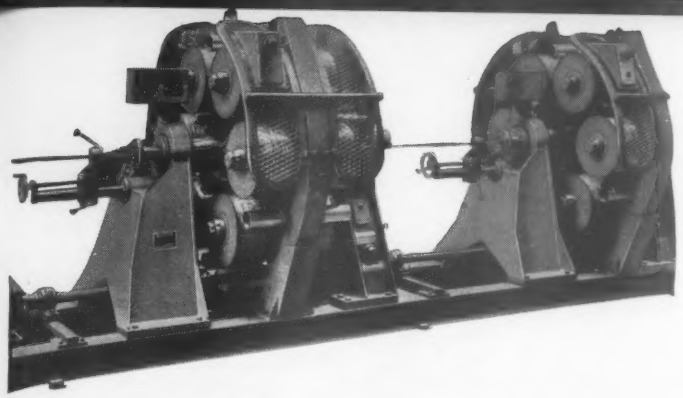

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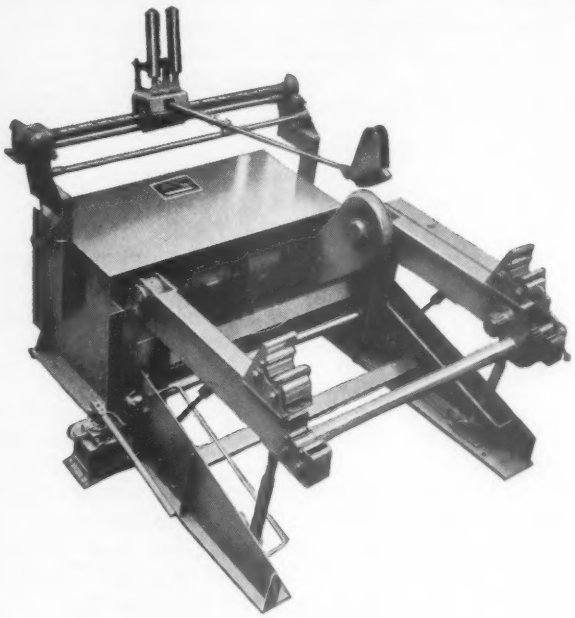

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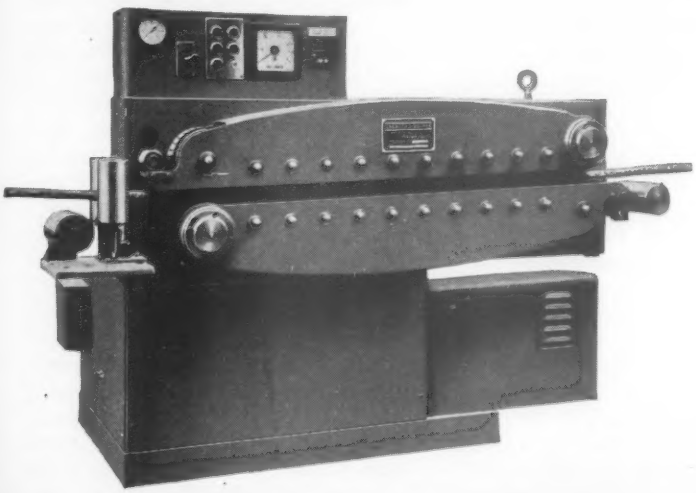

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The Caterpillar Haul-Off uses endless belts of rubber shoes which fully protect the cable during haul-off. Grip may be pre-selected and simply controlled. It is positive and constant throughout operation. The unit does not require special foundations or the usual haul-off drum pit. It can be used as a reliable independent measuring device.

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inum coated steel products by means of natural weathering and accelerated tests for more than 30 years. It has been found that no single accelerated test will establish the expected performance of the aluminum coated steel wire. However, by using a number of accelerated tests in combination, it has been possible to predict to some degree the expected performance of products of this type. Some of these tests are described below.

TABLE II

CORRELATION OF CONTINUITY TEST WITH ACCELERATED CORROSION TESTS ON ALUMINUM COATED STEEL WIRE

Lot Number	CC's of gas evolved in Continuity Test(1)	3 1/2% NaCl Int. Spray % of Area covered by rust	100% Relative Humidity at 125°F % of Area covered by rust
1	1.0	15(2)	1(2)
2	1.0	100(3)	

NOTES:

(1) Exposure for three hours in 15% nitric acid solution.

(2) Exposure of one year.

(3) Exposure of thirty weeks

TABLE III

PROPOSED SPECIFICATIONS FOR MINIMUM WEIGHT OF COATING ON ALUMINUM COATED STEEL WIRE

Nominal Diameter of Coated Wire, in.	Minimum Weight of Aluminum Coating oz. per sq. ft. of Uncoated Wire Surface	Zinc Equivalent Determined by Multiplying Wt. of Aluminum by Factor of 2.64
0.0500 to 0.0599, incl.	.28	.75
0.0600 to 0.0749, incl.	.30	.80
0.0750 to 0.0899, incl.	.32	.85
0.0900 to 0.1039, incl.	.34	.90
0.1040 to 0.1199, incl.	.36	.95
0.1200 to 0.1399, incl.	.38	1.00
0.1400 to 0.1799, incl.	.40	1.05
0.1800 to 0.1900, incl.	.42	1.10

TABLE IV

CORRELATION OF COATING WEIGHT WITH ACCELERATED CORROSION TESTS ON ALUMINUM COATED STEEL WIRE

Lot No.	Coating Weight oz/sq ft	3 1/2% NaCl Intermittent Spray Exposure	3 1/2% NaCl Intermittent Spray % of Area Covered by Rust
1	0.61	1 yr.	15
2	0.39	36 wks.	95
3	0.35	36 wks.	25
4	0.45	2 wks.	5

(1) Continuity Test

As has been stated previously, one of the greater problems associated with hot dip coating of steel with aluminum has been in obtaining a continuous coating on the steel wire. In order to evaluate the continuity of such coatings, a test was devised in which aluminum coated steel wire is exposed for three hours to a 15% solution of nitric acid at 75°F. A measured length of wire with cut ends sealed is exposed to this solution in an inverted burette so that the amount of gas evolved can be accurately measured. Since aluminum is highly resistant to nitric acid, the amount of gas evolved is a measure of the attack of the acid on any exposed steel. The coating is considered acceptable if less than 4cc of gas is evolved. This system was based originally on what was considered good quality wire, but the merits of the system have been proven by subsequent experience. Examinations comparing the performance of aluminum coated steel in this test with the results of other tests are shown in Table II. These data show that while this test has merit in establishing the quality and uniformity of aluminum coated steel wire, it can not always be relied upon to give expected performance data. It is unlikely that these variations are entirely within the accelerated tests being used, but rather are also probably the result of variations in the quality of the samples exposed to the hydrogen evolution test and those exposed to the accelerated corrosion tests.

(2) Coating Weight

Another method of evaluating aluminum coated steel wire is the measurement of the coating weight of the aluminum. This test is conducted by immersing aluminum coated steel specimens in a solution containing 200 grams of sodium hydroxide in 1000cc of water at a temperature of 180 to 200°F. The weight of aluminum coating is calculated from the weight loss. The minimum weight of coatings considered necessary for good performance on aluminum coated steel core wire for ACSR has not been established definitely. However, a proposed set of specifications is included in Table III. This method, again, should not be considered as a good test in itself to determine the life expectancy of aluminum coated steel wire, since it does not establish the continuity of the coating.

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Tests conducted at Alcoa Research Laboratories have shown that in general, samples having relatively thick aluminum coatings perform better than samples with thin aluminum coatings (Table IV). Other samples to illustrate that this test alone is not sufficient as a means of evaluation are included in Table IV.

(3) Uniformity Test

To help in predicting performance, another test was developed at the Alcoa Research Laboratories to determine the number and size of voids existing in aluminum coatings on steel wire. In this test, samples of aluminum coated steel wire are immersed in a gelatin slurry containing nitric acid and potassium ferricyanide. The nitric acid is added in order to make the steel anodic to the aluminum coating, and the potassium ferricyanide, of course, is added as an indicator for iron. By means of this test, it is possible to determine the number of voids and iron inclusions on the aluminum coated product. After immersion, the aluminum coated steel wire sample is carefully withdrawn so that the gelatin will dry and form a semi-permanent record. Because of the

semi-permanent nature of this test, it is possible to confirm the presence of these voids by microscopic examination. This test has been of considerable help in correlating the uniformity of the aluminum coating with resistance to corrosion in many environments. However, like the other accelerated tests, it can not be relied upon entirely to provide an accurate evaluation of the performance of the product. Here again, results have been obtained from accelerated corrosion tests which have confirmed the results of this test. However, in other cases, samples which have given one answer in this test have not performed as expected in accelerated corrosion tests. This is one of the many tests that can be used in conjunction with others to effectively determine the performance of aluminum coated steel wire.

(4) Accelerated Corrosion Tests

Description

Alcoa Research Laboratories normally employ two accelerated tests in determining the resistance to corrosion of aluminum coated steel and other products. One test involved intermittent exposure to 3-½% NaCl spray. In this test, samples are continuously wetted with salt spray for 16 hours and then the surfaces are permitted to gradually dry by exposure to the atmosphere in the Laboratory for eight hours. This exposure test was developed many years ago as one more severe than the conventional continuous salt spray test. The other test used involves the exposure of specimens to 100% relative humidity at 125°F.

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It has not been possible to correlate the results of these tests with the service life that might be expected from similar samples exposed to natural environments. However, these accelerated corrosion tests are of value in obtaining a relative evaluation of aluminum coated steel and other metallic products. A group of samples which perform better than another group of samples in these exposure tests would be expected to show a superiority when employed under most service conditions.

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Much of the work done in accelerated corrosion tests at these Laboratories has been carried out on aluminum coated steel core wire for ACSR. However, a few tests have been conducted on fence wire and screen wire fabricated from this product. In all cases, galvanized steel wire products have been included in the test for comparison purposes. In addition, aluminum alloy wires were included in many tests.

Results

Until the last few years, the aluminum coated steel wire products did not display adequate resistance to corrosion in either of the accelerated tests. In all cases, initial failure of the aluminum coated steel wire was observed in salt spray in not more than 60 days and in some cases within two days. Galvanized coatings, particularly those which were hot dipped did not show initial coating breakdown until much longer periods of time. Similarly, the condition of these lots of aluminum coated steel wire was poor when compared with galvanized wire after extended periods of exposure.

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In the humidity test, similar early failure occurred on the aluminum coated steel wire. However, the difference between these samples and the galvanized samples was not nearly as pronounced.

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With the continued development and improvement of aluminum coated steel wire, the performance in accelerated tests became increasingly better. Samples received during the past two years have required about 50 days to produce initial rusting in the salt spray test, and have performed very satisfactorily after as long as one year. In the humidity test, initial failures were observed only after about 40 days, and again these samples performed satisfactorily after exposure of one year. In both tests, these later lots of aluminum coated steel core wire were markedly superior to the hot dipped or electro-galvanized steel wire. However, in those cases where aluminum alloy wire was included, neither the aluminum coated steel wire nor galvanized steel wire were comparable to the aluminum wire in resistance to corrosion.

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As might be expected because of the protection afforded to the core wire by the aluminum strands, the resistance to corrosion of aluminum coated steel wire when employed as core wire in ACSR is superior to that of the wire exposed as single strands. In the salt spray test, aluminum coated steel wire with a coating of 0.45 oz/sq. ft. showed initial breakdown after two weeks as single strands but not until four weeks as core wire in ACSR.

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A few tests have been conducted on aluminum coated steel fence wire and screen wire. In general, neither of these products in the lots tested appear to have been developed to the same extent as has the aluminum coated steel core wire for ACSR. In both accelerated tests, the aluminum coated steel products were decidedly inferior to aluminum fencing and screening, and somewhat inferior to the same products made from galvanized steel. It is realized, of course, that these applications do not require the same high quality as far as resistance to corrosion is concerned as does core wire for ACSR. However, in resistance to corrosion, the lots tested of both of these aluminum coated steel wire products are inferior to the more recent production samples of core wire.

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In general, the accelerated tests show that aluminum coated steel core wire products having sufficient coating thickness and a uniform and continuous coating, are providing satisfactory resistance to corrosion which is at least equivalent and in many cases superior to that of galvanized steel core wire. However, in no case has the resistance to corrosion of aluminum coated steel core wire approached that of aluminum alloy wire.

(5) Natural Weathering Tests

While many environments throughout the country are used to conduct corrosion tests, Alcoa Research Laboratories employs two test stations to carry out the bulk of their investigations. One of these test stations is located on the roof of the Alcoa Research Laboratories at New Kensington, Pennsylvania, while the other is located at Point Judith, Rhode Island. The New Kensington test

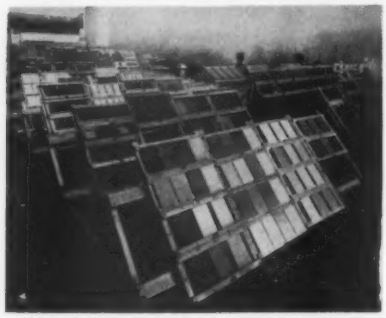

Figure 3—View of Alcoa's industrial exposure station located on the roof of the Alcoa Research Laboratories at New Kensington, Pa. This station involves not only exposure to the severe industrial atmosphere of that city but also to fumes emanating from the chemical exhaust hoods of these Laboratories. * * * *

station (Figure 3) provides a severe industrial atmosphere incorporating not only the industrial environment of that city but also the fumes emanating from the chemical exhaust hoods. The test station at Point Judith, Rhode Island, (Figure 4) is located only 300 feet from the water's edge along a rocky coast where the sea is often rough, so that there is usually considerable salt mist present in the air. It represents an aggressive marine environment.

Figure 4—Aerial view and close-up (inset) of Alcoa's seacoast exposure station at Point Judith, R.I. The station is located on a stony beach about 300 feet from the water's edge and it faces the prevailing winds from the ocean. At this and all of the other Alcoa exposure stations the test specimens were inclined at an angle of 45 degrees, facing south.—(Aerial photo—courtesy of Providence (R.I.) Sunday Journal.) * * *

TABLE V

TENSILE STRENGTH REQUIREMENTS OF ALUMINUM COATED STEEL WIRE

Nominal Diameter, in.	Stress at 1 per cent Extension min. psi	Ultimate Tensile Strength min. psi	Ultimate Elongation min. per cent in 10 in.
0.0550 to 0.0899, incl.	170 000	190 000	3 1/2
0.0900 to 0.1199, incl.	160 000	190 000	4
0.1200 to 0.1384, incl.	150 000	185 000	4
0.1385 to 0.1900, incl.	135 000	175 000	5

Exposure of some of the older lots of aluminum coated steel wire revealed that initial rusting in the seacoast atmosphere occurred in as little as three months and not longer than 15 months. Galvanized steel samples with comparable coating thickness did not show rusting after as long as 18 months. The most recent lots of aluminum coated steel wire appear to be performing about as well as the galvanized steel having equivalent coating thickness after shorter periods of exposure.

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In the industrial atmosphere at New Kensington, some of the older lots of aluminum coated steel wire showed initial breakdown in as little as one month, while some did not until after exposure of seven years. The galvanized steel samples in this environment showed evidence of initial failure in about approximately two years. The lots of aluminum coated steel wire made more recently have performed very satisfactorily and appear to be superior to galvanized steel samples having coatings of similar thickness.

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As in accelerated tests, performance of both aluminum coated steel and galvanized steel core wire in natural environments is improved when employed in ACSR, as compared to exposure as single strands. However, even though the performance of the two different types of core wire is improved when employed in ACSR, the aluminum coated steel has an advantage in that the dissimilar metal effect between the zinc coating on the galvanized core wire and the aluminum strands is eliminated. In other words, the aluminum coating will not corrode to protect the aluminum strands as will the zinc coating.

(6) Properties

As has been stated previously, another of the difficulties in the fabrication of the aluminum coated steel core wire has been associated with the mechanical properties of the wire. Because of the process involved, it has been difficult to obtain the proper tensile properties after aluminum coating. However, on the most recent lots of material fabricated commercially, satisfactory mechanical properties have been obtained. Table V includes the minimum required properties for various diameters of core wire. These properties correspond to those of Grade B Electro-galvanized-ASTM Spec. B261-55.

Service

Since aluminum coated steel core wire, particularly that for use as core wire in ACSR, is in the developmental stage, there is very little service life data available to discuss. However, Alcoa has employed ACSR utilizing aluminum coated steel core wire (0.45 oz/sq. ft. coating weight) in an installation at the Massena, New York plant. When this energized line was last inspected after service of eight years, the aluminum coated steel core wire was performing satisfactorily.

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It is understood that several manufacturers are now producing aluminum coated steel fence wire commercially and have some limited service life statistics available. According to unofficial reports, the aluminum coated steel

(*Please turn to page* 1404)

Discussions Following Symposium on Aluminizing

October 13, 1958

MODERATOR

C. C. Tappero, Wire Mill Superintendent
The Colorado Fuel and Iron Corporation
Pueblo, Colorado

Tom M. Girdler, Jr., President of the Association, opened the technical sessions by welcoming the group to the Twenty-Ninth Annual Convention, noting that membership had grown in the 29 years from 178 to 1382 and that 16 persons from overseas were in attendance. He announced the new officers for the coming year, asking each to stand as their names were called.

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The questions and answers following the presentation of the five papers in this Symposium are summarized here.

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Mr. Griffiths was asked as to the effect of the silicon content of the steel in the formation of the iron-aluminum alloy layer. He reported that in galvanizing they had always resorted to siliconized steel to control the diffusion of zinc into the steel, but in aluminizing the silicon was more effective when added to the aluminum bath to control to some degree the matter of diffusion. Beryllium, he said, as had been mentioned, was more effective, but not used because of its toxicity. A silicon content of 1% in the steel, it was pointed out, was not as effective as the addition of the element to bath.

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A comment from the floor brought out that experiments with low carbon rimmed and killed steels showed no difference in the thickness of the iron-aluminum alloy where the aluminum alloy contained silicon.

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Comparing copper coating with aluminum coating, the former of necessity being continuous, a member asked Mr. Whitney whether there would be galvanic protection in Alumoweld wire if the steel core should become exposed. Mr. Whitney replied that in the samples shown notches had been filed that gave no indication of accelerated corrosion, but the tests had only been conducted for one year. He noted that other panelists had observed that there had been no corrosion over much longer periods in any areas where the steel had been exposed.

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Mr. Joy, in response to a comment that his charts showed the same weight of aluminum vs. zinc on corrosion, stated that aluminum, being lighter in weight, had resulted in the comparisons being made in thickness rather than weight. On this basis the aluminum coating weight in industrial atmospheres was 3 to 4 times that of the zinc. Mr. Griffiths added that pessimists believed aluminum coatings would outlast zinc by 10 times and optimists said it had a life factor of 20 times. Mr. Joy remarked that they had had 20 year tests and the wire still hadn't rusted, whereas zinc coated wire had completely rusted in 8 years. Mr. Englehart added that thickness as opposed to weight gave a more favorable picture.

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A member stated that Mr. Griffiths' chart showed that the weight of coating increased with speed and asked if the coating thickness was uniformly maintained with the speed increase. He replied that at lower speeds, better control was possible. With a .2 ounce coating, they were extremely smooth, but with a .5 ounce coating it was slightly less smooth, indicating that higher speeds showed less uniformity.

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Mr. Joy referred back to the silicon condition, saying that while they had not gone into this particular aspect, they had coated practically all analyses of steel, including stainless, alloy and boron steels, and they had all been coated successfully. On stainless steels the high temperature characteristics had been enhanced.

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A member asked Mr. Griffiths if the increase in the wire speed in the bath would not result in a thinner coating instead of a heavier one, to which he replied, that this was nothing new in aluminum coatings—the higher the exit speed, the heavier the coating.

★ ★ ★

There being no further questions, the meeting adjourned at 4:45 o'clock.

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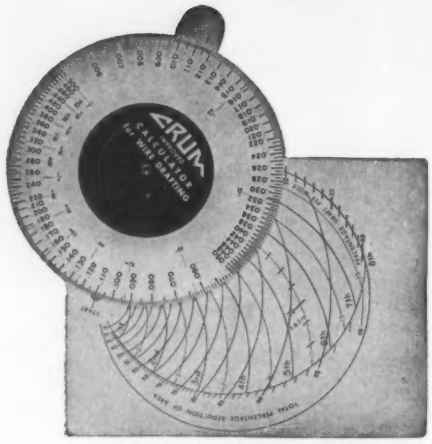

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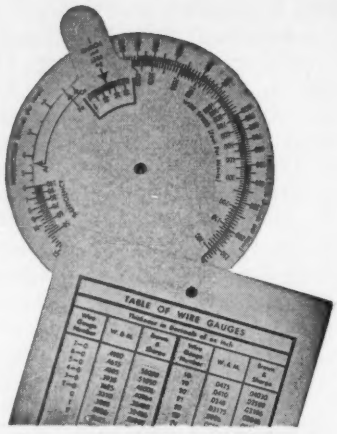

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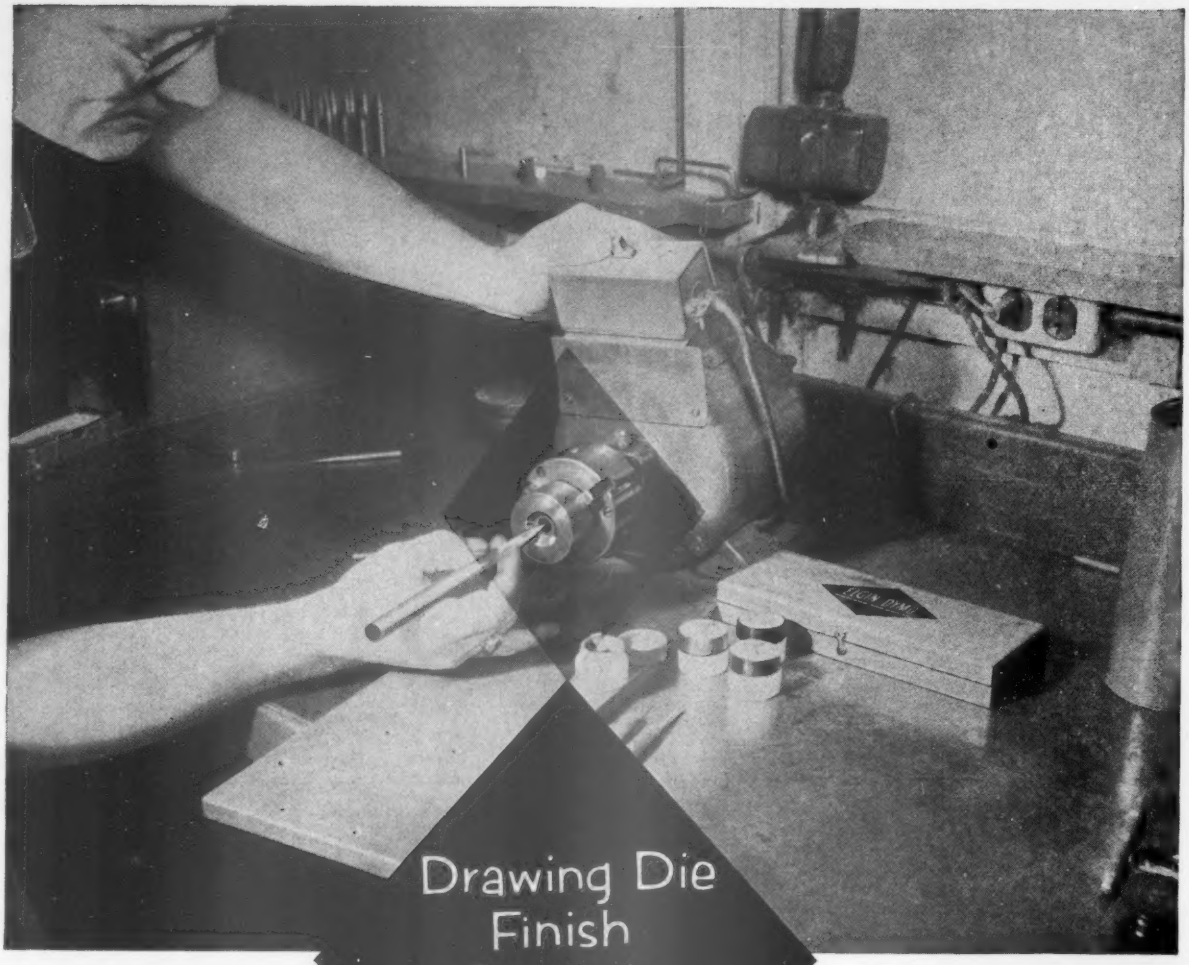

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The New Galvanizing Line at Greenings

by

G. R. Armstrong, Chief Eng.
G. V. Globe, Supt., Wire Mill
The B. Greening Wire Co., Ltd.
Hamilton, Ont., Canada.

and

Richard Bliss, Unit Leader
Furnace & Associated Plant
Equipment Sales,
Industrial Heating Dept.
The General Electric Company
Shelbyville, Indiana

This paper was presented by Mr. Bliss at the Annual Convention of The Wire Association in Atlantic City, N. J. on October 14, 1958.

"**Cut** Cost, Improve Quality and Expand Production." These were the objectives sought by the Management of the B. Greening Wire Company, Ltd., Hamilton, Ont., Canada, in planning new facilities for the production of galvanized low carbon steel wire. The story of how these objectives were realized is the subject of this paper.

★ ★ ★

The B. Greening Wire Company manufactures a broad line of wire rope, wire cloth, wire lath and perforated metals. Among the products of this Company can be found wire work of every description.

★ ★ ★

This Company processes galvanized low carbon steel wire which is used in the manufacture of clothesline, T. V. strand, poultry netting, weaving applications and resale.

★ ★ ★

Wire produced for this class of product fall in the numbers 21 to 18 steel wire gauge range, .031 to .047" in diameter. Materials are low carbon steels with carbon contents of .05 to .09 percent. When ready for galvanizing, the wire is delivered from the drawing machines as drawn, lubricated with dry metallic soaps, and has tensile strengths of the order of 120,000 to 140,000 lbs. per square inch.

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End use requirements for this type wire dictated certain quality and physical features to be produced in the final processing. Zinc coatings on the order of 0.15 ounces per square foot were required and it was desired that the equipment have provisions to produce coatings up to 0.20 ounces per square foot. High degrees of smoothness of coat and good adherence properties were desired. In physicals, a #7 to #8 ASTM ferrite grain size structure was required. Specifications called for an ultimate strength of 65,000 psi, a yield strength of 49,000 psi and elongation values of 15 to 20 percent.

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This galvanizing job was not new at Greenings. However, in their old operations a batch annealing cycle arrangement was used followed by acid and flux treatments prior to the application of the zinc coat. These operations required considerable labor and trucking for material handling and trucking expense for material transfer from one process to another. Additional expense was incurred in the cost of the acid flux surface pre-treatments prior to galvanizing. In addition, the quality of the coat left something to be desired, especially in its adherence qualities.

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Substantial savings had been made in the wire industry by combining the process anneal and the galvanized coating in an integrated continuous operation, thereby eliminating the relatively high labor expenses associated with batch annealing. Economic studies were made of the conventional lead annealing and galvanizing line set up utilizing the continuous flow strand type of operation.

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Further investigations of the problems of achieving lower cost and improved quality led Greening to a consideration of the possibility of using atmosphere surface pre-treatment, prior to galvanizing, as a more economical method of cleaning the wire than the acid, flux and water rinse systems associated with the lead annealing and galvanizing line.

★ ★ ★

Atmosphere pre-treatment of steel prior to metal coating is not in itself new. It has been used for many years in the preparation of continuously moving steel sheet and strip. However, the original thinking to apply the process to wire was independently thought of by **The B. Greening Company.**

★ ★ ★

The atmosphere pre-treatment of the surface of low carbon steel, prior to metal coating, consists of two stages.

★ ★ ★

In the first stage, the material is heated in an atmosphere containing oxygen so that a light oxide film is created on the surface of the material being processed.

★ ★ ★

Subsequently, in the second stage, the material, with the oxide surface coat, is passed through a reducing atmosphere, meanwhile being held at an elevated temperature. In this atmosphere, the surface oxides are reduced leaving a layer of pure sponge iron on the surface of the material. The presence of sponge iron at the surface promotes a subsequent keying action of the zinc which gives an exceptionally tight bond. The reduced immersion time of the wire in the zinc reduces the

percentage of amalgamation of zinc with the iron resulting in a much thinner layer of brittle alloy. Thus wire coated by this process can be bent and flexed with less hazard of cracking or flaking the coat.

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Consideration of the atmosphere pre-treatment possibilities led Greenings to believe that such a treatment could be accomplished successfully during the process anneal which was required to produce the desired physicals in this application. Literature searches on the subject did not produce satisfactory data or information on which the design of equipment could be based. Consequently it became necessary to resort to process development experiments to determine the required equipment.

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The effects of atmosphere pre-treatment were fairly well established for low carbon steels. Galvanizing requirements also were substantiated on the basis of previous experience. The principle unknown in this application problem involved determination of the time required to heat the material to annealing temperature, in the various sizes under consideration, and the time required for these materials to be held at temperature to allow a satisfactory degree of recrystalization and grain growth to yield the desired physical properties. These properties had to be determined precisely, prior to the design and installation of equipment, in order to be certain that the final installation would perform the necessary and desired work.

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The planning of the process was to use a continuous anneal and galvanize set up of the short time subcritical type where the material is heated to initiate re-crystallization and subsequent grain growth to change the elongated "as drawn" structure to a relatively equi-axed type of small grain structure. When heated to temperatures above 840 F., iron recrystallizes with nucleation taking point at points of highest stress occurring at interstices of grain boundaries and twinning planes. Prolonging duration of time at temperature, promotes grain growth to a larger magnitude of sizes.

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Greening's ran heating time versus temperature tests in an existing 16 ft. tube furnace. In these tests, wires were run at various speeds through the furnace where the temperature level was set at different values. A spread of temperatures and speeds were selected to encompass the probable heating time values.

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It is most difficult to determine the exact temperature achieved by a wire moving at high speeds through a heated temperature zone by direct temperature measurement. Therefore it was decided to determine the physical characteristics of the wire produced under the various test conditions and, from inspection of these characteristics, attempt to determine the temperature which had been achieved by the wire under the given test conditions.

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Table 1 lists the direct measurements obtained on wire physicals for the various wire speed determination tests run in the 16 ft. tube furnace. These are quite interesting in themselves as they show the effects, in terms of physical properties, of running the wire at various speeds through various temperature levels.

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From the results of **Table 1,** combined with metallographic grain growth determinations, the temperatures achieved by the moving wires were deduced as tabulated in Table 2.

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Other determinations resulted in the specification of a temperature of about 1300 to 1350 F. as the temperature at which satisfactory degree of oxide formation

TABLE 1 - Results of wire speed determination tests run in Greening 16 foot tube furnace showing variation in physical results obtained at various temperatures and heating times

Time in furnace - Speed -		A 19 sec. 50 fpm	B 9.6 sec. 100	C 6.3 150	D 4.8 200
1250° F.	grain	#9AS1M Ferrite	Ferrite	Slight Recryst. Ferrite	No recryst.
	Ult.	66500 psi	65000	75000	110,000
	Yield	49000 psi	50500	72000	109,000
	Elong.	23.3%	23.3	10.0	1.5
1400° F.	grain	8 Ferrite	9 Ferrite	10 Ferrite	Slight Recryst. Ferrite
	Ult.	66000	65500	66000	71000
	Yield	49000	47500	53000	65000
	Elong.	21.7	22	20.0	15%
1500° F.	grain	7 Ferrite & 10 Aust.	9 Ferrite	10 Ferrite	Slight Recryst.
	Ult.	65000	67000	68000	70000
	Yield	47500	50000	53000	63000
	Elong.	23.3	23.3	21.7	18.3%
1600° F.	grain	10 Aust.	8 & 10 Duplex	8 Ferrite	10 Ferrite
	Ult.	65000	66000	67500	67500
	Yield	49000	52000	53000	56000
	Elong.	23.3	20%	17%	18.33
1820° F.	grain	10 Aust.	10 Aust.	10 Aust.	#8 Ferrite
	Ult.	65500	69000	77000	69000
	Yield	47500	53000	57000	54000
	Elong.	25	25%	20%	18.39
2000° F.	grain	9 Ferrite & 10 Aust.	#10 Aust.	10 Aust.	10 Aust.
	Ult.	65500	67500	73000	69000
	Yield	47500	50500	56000	54000
	Elong.	23.3	21.7	20.0	18.0
Check test to see how re-running offsets results.					
1500° F.	Wire run @ 200 fpm and then re-run @ 50-100-150 & 200 fpm.				
	grain	8 Ferrite & 10 Aust.	10	10	#10
	Ult.	66000	68500	68500	68500
	Yield	48500	51000	54000	59000
	Elong.	21.7	21.	20	21.0

TABLE 2 - Interpretation of results of wire speed determination tests in terms of temperature of wire.

Furnace Temp° F.	50 fpm 19 secs.	100 fpm 9.6 secs.	150 fpm 6.3 secs.	200 fpm 4.8 secs.
1250	1150° F#	900° F#	800° F#	700° F#
1400	1300# (12 secs.)	1200#[A] (3.3 secs.)	900 # (0 secs.)	750#
1500	1430* (12 secs.)	1300 * (3.5 secs.)	950 * (.5 sec.)	850 *
1600	above 1500#	above 1330#	1300#	950#
1820	above 1500#	above 1500#	about 1500#	1300 [B] #
2000	above 1500#	above 1500#	about 1500#	above 1500#

A - Basis of soak time:
Wire is above 1200° F. for 19 - 9.6 = 9.4 secs.
Takes 4 - 5 sec. to heat from 1330 to 1430 @ Fce. Temp. 1520° F.

B - Basis of heat up time -

Above Temperatures based upon:

*1. From curve data H4990951 sheet 4.

#2. From metallurgical change indicated by presence of grain growth and structure.

NOTE: Bracketed figures are estimated periods of time part is above 900° F. Assuming metallurgical changes - grain growth and strain relief take place above 900° F., it is important to indicate length of time part is above 900° F.

and reduction would take place to yield the desired surface pre-treatment effects. Consequently the overall process cycle determination required that the material be treated by heating it to 1350°F. and holding for a sufficient time to permit both surface treatment and metallurgical results to take place. For the metallurgical anneal portion of the problem, the time of grain growth would be taken as the time the material was above 900 degrees plus the soaking time required to reduce the surface oxides and to produce the desired metallurgical results.

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Table 2 also illustrates one of the problems in the equipment design. This problem is the fact that the time required to heat the material from cold to 1300 degrees, in a 1300 degree furnace, would require a piece of equipment approximately 100 ft. long excluding soaking time. In order to cut the size, and also cost, of the equipment, it was decided to take advantage of the benefits offered by employing gradient heating to speed up the heating time. Therefore, from the observation that the wire would heat to 1300 degrees in a furnace at 1820° in 4.8 seconds, it was decided to break the furnace up into two portions. The first portion would be used as a high temperature pre-heat furnace to bring the wire up to the approximate treatment temperature. Once at that temperature, the wire would pass into a holding furnace where it would be held at the required temperature level for the necessary soaking time.

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With these thoughts in mind, cycle times of approximately 4.0 seconds for pre-heat of the wire to 1350°F., in a 1900°F. furnace, and a holding zone maintained at 1300°F. for a material time of 9 seconds were determined as the basis of design of equipment.

★ ★ ★

Detailed cost investigations were made of the atmosphere pre-treatment process in competition with other methods of accomplishing combined annealing and galvanizing operations in which the atmosphere pre-treatment showed substantial cost savings and improvement in operating conditions. The decision was made to proceed with an atmosphere pre-treatment process, using all electrically heated components to achieve the close temperature control desired to produce superior coating properties with minimum zinc consumption and dross formation.

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The process cycle requirements on which equipment designs were based, are illustrated in graphical form in Fig. 1.

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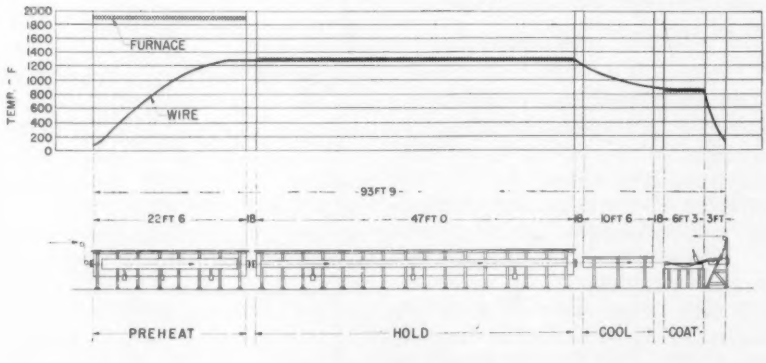
On the basis of operating the equipment at 300 ft. per minute, the equipment was to be furnished with a pre-heat furnace section having an effective heat of 20 ft. in which the wire would be heated to 1350°F with the furnace pre-heat section controlling at 1900°F. A 45 ft. effective heating length holding furnace would be employed to hold the work temperature at 1300°F. for a period of 9 seconds. A short cooling section would be employed to reduce the temperature of the material to approximately 900°F prior to entering the

CONTINUOUS WIRE GALVANIZING LINE



TEMPERATURE PROFILE

Fig. 1

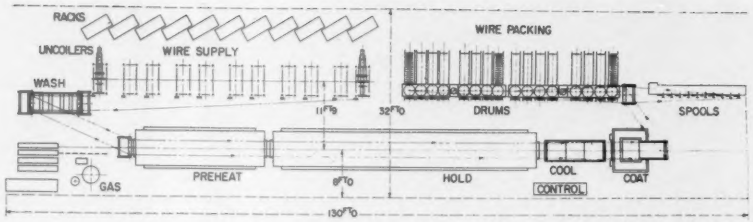
galvanizing pot where the molten zinc metal would be held at approximately 840°F. After leaving the galvanizing pot, the wire would be water quenched to room temperature.

★ ★ ★

The resultant installation is shown in Fig. 2.

★ ★ ★

The galvanizing line starts in the left background of Fig. 2, with wires in process running successively through the 20 ft. pre-heat furnace, the 45 ft. holding furnace a 10 ft. cooling section into the galvanizing pot in the immediate foreground. Wire handling supply and packaging components are grouped in the right background in this view.



CONTINUOUS WIRE GALVANIZING LINE

Fig. 3

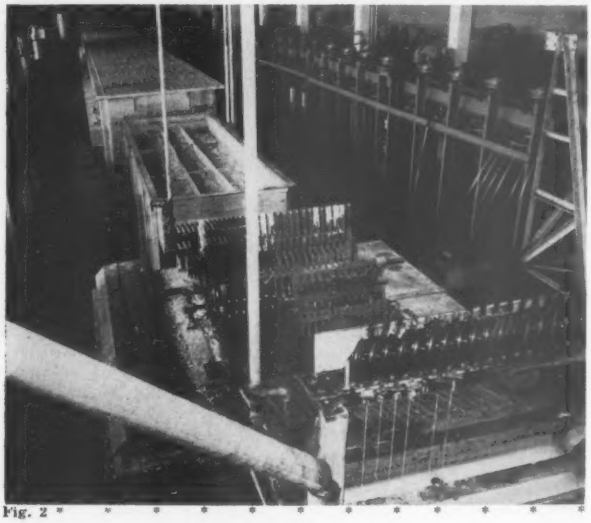


Fig. 2

Fig. 3 shows the plan layout of the equipment as installed, illustrating the flow of wire material from the wire supply stands through the processing equipment to the wire packaging stands.

★ ★ ★

Limitations of space yielded a peculiar benefit to the economy of operation of this line. The length of floor space available for this equipment was only a little longer than that required for the pre-heat, hold, cool and galvanizing sections. Consequently, it was necessary to double up the installations by putting the wire supply and the wire packaging equipment alongside the furnace equipment. This brought the supply and packaging components side by side making it possible for one operator to service the entire equipment, drastically reducing the cost of labor content in operating the process.

★ ★ ★

Fig. 4 shows a view of the equipment from the furnace entrance end.

Fig. 4

The pre-heat furnace on the right is rated 225 KW, 550 Volts, 60 Cycle, 3 Phase. The heat in the furnace is divided into three zones in order that closer control of temperature gradient and heating rate can be achieved through differential adjustment of temperatures in various portions of the oven.

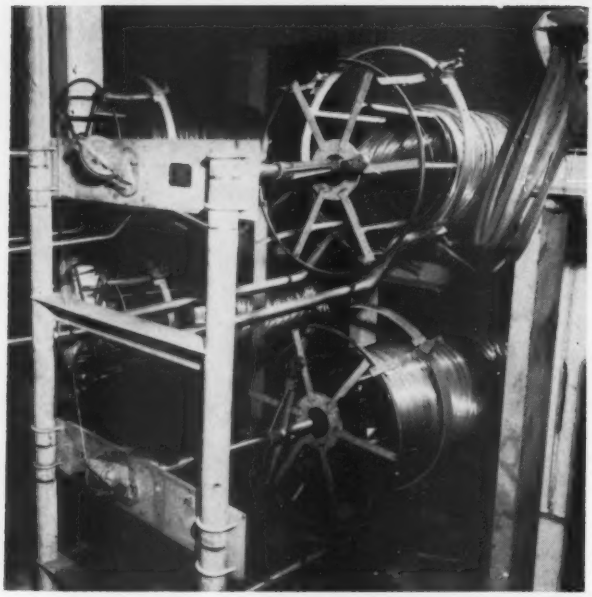
★ ★ ★

The furnace is constructed to be capable of continuous operation at 1950°F. Thermal insulation consisting of 4½ inches of fire brick backed up with 10 inches of light weight insulation are supported and contained in a welded gas tight casing, the top of which is removable for servicing purposes.

The holding furnace is illlustrated immediately behind the pre-heat furnace. Construction of the holding furnace is similar to that of the pre-heat furnace except that it is dimensionally smaller in cross section, although longer in length. Being rated for continuous operation at 1400 F., this furnace only requires 7½ inches of back-up insulation together with a 4½ inch face fire brick lining. The effective heating length of the holding furnace is 45 ft. Rating of the holding furnace is relatively low, 45 KW, for the furnace heat input is required only to offset thermal losses through the walls, since the wire has already been brought up to temperature in the pre-heat furnace. Three separate control zones are again used in order to provide flexibility and closeness of temperature control.

★ ★ ★

Silicon carbide tubular heating elements are employed as thermal heat dissipation units in the pre-heat furnace. While not strictly required for the temperature levels involved in this furnace, this type of heating element was selected for the economies offered



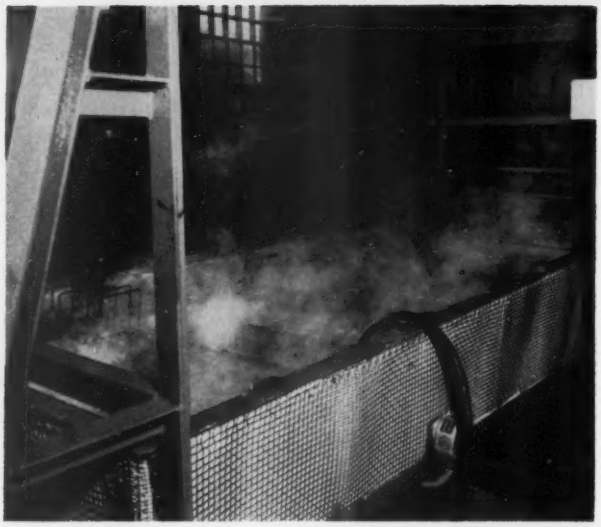


Fig. 6 (Above)

Fig. 5. (Left)

in furnace construction and for ease in maintenance. This type of heat element can be changed without dismantling the furnace and without shutting down production. Resistance ribbon type elements are employed in the lower temperature rated holding furnace.

★ ★ ★

A 10 ft. cooling section is employed as a means of controlling cooling of the wire from the holding furnace prior to its entry in the zinc bath. While designed originally to use continuously circulating water as a cooling medium, it was found in practice that superior metallurgical results were obtained, without effecting the galvanized bond, with the cooler were used as an extended holding section by covering wire guide tubes with mica flake insulation.

★ ★ ★

The "as drawn" wire is delivered to the galvanizing line in 200 lb. hanks by fork trucks, from the drawing machines. Uncoiling is accomplished in horizontal arbor rotating flyer type supply stands, designed for this operation, and shown in Fig. 5. Center mounted swivel adjusting guide sheaves are used on the pull-out to carry the wire to overhead tubes and sheave guides leading to the process equipment.

★ ★ ★

The first step in the process is hot water wash carried out in the tank shown in Fig. 6. The moving wire is guided through a series of dividers in which are mounted stainless steel wool wipers which remove dirt and grease from the surface of the wire. Hot water used in the wash process is continuously recirculated through filters so that dirt and accumulated soaps can be removed and the water re-used to save make-up water.

★ ★ ★

Motor driven guide sheaves, similar to that shown in the left portion of Fig. 7, are used at various points in the equipment to move the wire through the equipment at required speeds and at the same time driving the wire at various points to reduce frictional drag which might cause an excessive number of wire breaks and stretching.

★ ★ ★

The wires being processed run through the pre-heat oxidizing furnace and the holding and reducing furnace with each wire running in an individual tube. In the pre-heat furnace, air atmosphere is maintained on the inside of the tube and around the wire. In the holding furnace cooling section, all the way to the galvanizing pot, a reducing atmosphere containing approximately 75% hydrogen, 25% nitrogen is maintained in the tubes around the wire at all times. The furnace tubes are constructed of high temperature resistance alloy material and serve to support and guide the wire in its passage through the equipment, at the same time maintaining the proper atmosphere for the atmosphere surface pre-treatment part of the cycle.

★ ★ ★

The furnaces have internal clearance widths to accommodate 24 individual tubes, each 3/8 inch internal diameter, located on one inch centers. While the equipment normally operates with 22 lines of wire, 24 tubes were built throughout the equipment to give two extra tubes for stringing purposes, flexibility and possible tube failure.

★ ★ ★

In the furnaces, the wire guide tubes are supported in alloy resistant castings mounted on refractory piers spaced along the floor of the furnace. Tubes are clamped at the exit end of the furnace solidly and are permitted to expand toward the in-going end of the furnace.

★ ★ ★

The zinc coat is applied to the wire in the galvanized pot shown in the foreground of Figure 8. The actual galvanizing pot is 30 inches by 30 inches by 36 inches deep, mounted in an insulated support housing in which are contained

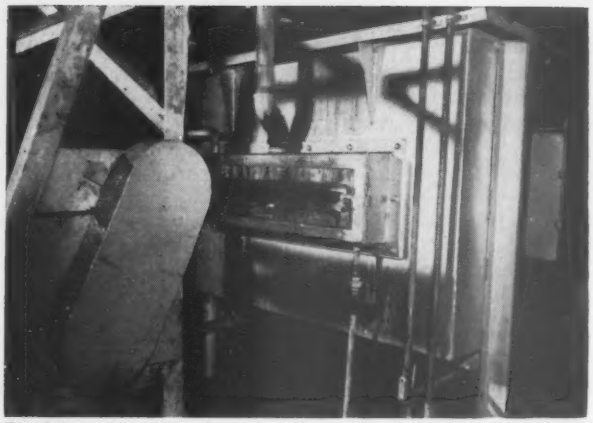


Fig. 7 * * * * * * * * * * * *

Fig. 8 * * * * * * * * * * * *

Fig. 9 * * * * * * * * * * * *

Fig. 10 * * * * * * * * * * *

the pot. Consequently, heat is transferred from the process wire to the pot, thereby reducing the need for heat input to keep the metal molten. The possibility of having to remove excess heat so that the zinc pot did not overheat causing damage to the equipment and excessive dross formation was considered and consequently the galvanizing pot was designed with a means for circulating cooling air around the pot to remove heat as may be needed, as well as with heating elements to provide heat

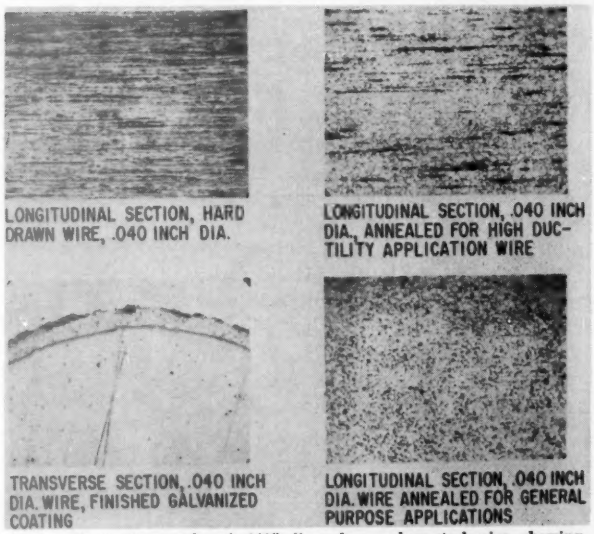

LONGITUDINAL SECTION, HARD DRAWN WIRE, .040 INCH DIA.
LONGITUDINAL SECTION, .040 INCH DIA., ANNEALED FOR HIGH DUCTILITY APPLICATION WIRE
TRANSVERSE SECTION, .040 INCH DIA. WIRE, FINISHED GALVANIZED COATING
LONGITUDINAL SECTION, .040 INCH DIA. WIRE ANNEALED FOR GENERAL PURPOSE APPLICATIONS

Fig. 11—Photomicrographs of .040" diam. low carbon steel wire, showing metallurgical structure alteration effect of anneal, and showing finished galvanize coat on wire. Magnification: 200X. * * * * * *

heating elements having a rating of 20 KW to maintain temperatures and offset surface heat losses.

★ ★ ★

The construction of the galvanizing pot contains an interesting feature. Contrary to many existing galvanizing lines, the wire to be coated enters the galvanizing pot at a temperature higher than the temperature of the molten zinc in when running small sizes of wire.

★ ★ ★

The individual tubes carrying the wires are visible in the lower right hand corner of Figure 8. Immediately above the ends of the

tubes can be seen the gas manifold which distributes reducing atmosphere to each individual wire guide tube. Gas is fed into a swivel valve arrangement on the end of each tube. This device is arranged with a short piece of tubing which projects into the surface of the molten zinc. When wire is being coated, the tube is depressed to pass the wire into the molten metal.

★ ★ ★

Swivel type sinkers are used to depress the moving wire below the surface of the molten metal. A heat and abrasion resistant metal is used for the tips of the individual sinkers to ensure long life of these parts.

★ ★ ★

The coated wire is given an asbestos wipe immediately upon exit from the zinc bath. This is accomplished in weighted wick boxes located immediately behind the sinkers at the outgoing edge of the zinc bath.

★ ★ ★

After wiping, the zinc coated wires move into a grooved water quench box where they are cooled to approximately room temperature. Upon exit from the quench box the wires are guided to the wire packaging equipment.

★ ★ ★

The material handling area, at the packaging end of the line, is shown in Figure 9. Galvanized wire is packaged for both inplant transfer and for external shipment, in 500 lb. fibre drums. Spoolers are available to handle a portion of the production of the galvanize line as required. Packing of the wire is accomplished by dead block drum packaging installations shown at the left hand side of Figure 9.

★ ★ ★

Packaging units are arranged in multiples of 8 heads each. Each head is equipped with an individual shut off mechanism and also with an individual speed adjustment arrangement so that the speed of wires can be adjusted individually if desired. Automatic devices detect wire breaks to shut down the particular head involved. This is to avoid pulling the end completely out of the equipment and to avoid the work of rethreading. A signal light and alarm arrangement indicates which line has broken out so that the operator can repair the damage quickly.

★ ★ ★

Drum packaging is done with drums mounted on a short piece of conveyor, one conveyor section for each head. This facilitates drum changing. When a drum is to be changed, the operator simply cuts the end and pushes the loaded drum out from under the packing head onto the extended conveyor shown in Figure 9. A new drum is put in place and the new end is quickly fed into the new drum.

★ ★ ★

Loaded drums are picked up periodically from the extended conveyor sections by material handling operators. This enables the galvanizing line operator to adequately service both supply and packaging ends of the equipment.

★ ★ ★

At the right of Figure 9 is shown the racks which are used to transport bare wire hanks from the drawing machines to the galvanizing line site. An overhead crane services both the supply and packaging ends of the machine to permit operators to handle the 200 lb. supply hanks and the 500 lb. shipment drums.

★ ★ ★

From the inception of thinking of the galvanizing line, it was realized that close control of temperature would be required to achieve the best possible quality of product. To meet this objective the temperature control systems applied to the pre-heat furnace utilized saturable reactor control on the two out-going zones of the pre-heat furnace.

★ ★ ★

Figure 10 shows the instrumentation applied to the line. Each zone of the pre-heat and each zone of the holding furnace is equipped with its own temperature controller. In addition, over temperature protection is provided for these furnaces. The galvanizing pot is equipped with a molten metal temperature indicator and a pot temperature indicator which operate to maintain the correct temperature of molten metal employing a two point control system. A multi-point recorder is employed to record the temperatures in the galvanizing pot and in each of the zone temperatures and of the pot temperatures.

★ ★ ★

The equipment chosen by **The B. Greening Wire Company, Ltd.** has proved itself to be satisfactory, based on operating results to date.

★ ★ ★

The quality of wire produced on the new line has been judged to be definitely superior to that produced by older methods. The physical results desired, in terms of structure, tensile strength, elongation, etc. have been realized in most instances. Metallographic studies show that desired grain structures and coatings have been attained as illustrated in Figure 11.

★ ★ ★

In this illustration, at upper left is a longitudinal section of the wire prior to entering the annealing section. With magnification of 200 the pearlitic stringers in elongated ferrite show very well the characteristics of hard drawn low carbon steel wire.

★ ★ ★

At upper right is a longitudinal section of the wire after it has passed through the annealing and holding furnaces. Again magnification is 200. Pearlite stringers in grains of ferrite are quite clear. This structure is characteristic of galvanized wire used for poultry netting, T.V. strand, etc.

★ ★ ★

At lower right is a longitudinal section of the wire after it has passed through the annealing and holding furnaces at a reduced speed. This wire is so processed when ductility and elongation are important factors such as galvanized wire for redrawing to smaller gauges. It is to be noted that pearlite stringers have been dissolved and the structure obtained consists of ferrite with pearlite at the grain boundaries.

(*Please turn to page* 1405)

Government to Stockpile Dies

The General Services Administration announced on September 30 that it will purchase mounted and unmounted industrial diamond dies for the national stockpile. The current need is for dies ranging in size from .0002 and smaller to .0007.

★ ★ ★

GSA's Defense Materials Service, which administers the stockpile, already has sent invitations to participate in the program to members of the diamond die industry. Suppliers not reached through this mailing may procure invitations to bid by calling or writing the Industry Branch, Defense Materials Service, GSA Regional Office Building, Washington 25, D. C., by October 7, 1958. Offers must be returned within 30 days from the date the invitations are issued.

★ ★ ★

According to the GSA requirements, diamond die offers should be based on estimates of monthly deliveries covering a twelve-month period, exclusive of lead time. The agency also is asking bidders to indicate the time required between the contract award date and the beginning of deliveries and whether the dies offered are to be procured from domestic or foreign sources. A "domestic" product is defined as one entirely manufactured within the continental limits of the United States. Not more than 50% of the purchases under the current program will be made from foreign sources nor less than 50% from domestic sources.

Aluminum Weldor's Training Manual—Inert Gas Process

Instructional information designed to train and qualify individuals in welding aluminum by the inert gas process is presented in Kaiser Aluminum Weldor's Training Manual. This new 144-page booklet is made available to the metal fabricating industry by **Kaiser Aluminum & Chemical Sales, Inc.,** 919 N. Michigan Ave., Chicago 11, Ill.

Material in this publication covers three primary functions essential to aluminum welding. In the first section of the booklet essential factors about both tungsten-inert-gas and metal-inert-gas welding techniques are presented. The second and third sections of the manual offer step-by-step exercises to follow in order to become proficient in metal-inert-gas welding.

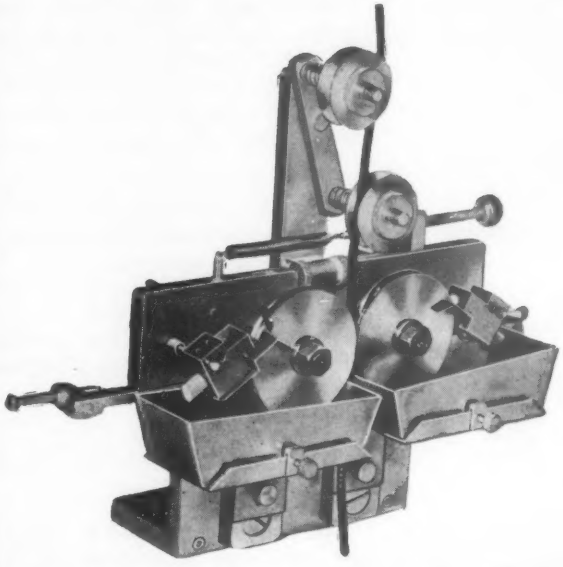
★ ★ ★

The exercises suggested are based upon actual practices originated in the Company's Department of Metallurgical Research. They are designed to establish an efficient and usable procedure for welding aluminum both in the plant and in the field.

★ ★ ★

This new Weldor's Training Manual fulfills a definite need in supplying much sought after information on welding aluminum with the inert gas process. Copy of the booklet may be obtained free when requested upon company letterhead. A charge of $1.00 per copy

MARKING WHEELS and MACHINES for ELECTRIC WIRE



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Bulletin on Metal Cleaning Costs

A new method for quickly analyzing and comparing metal cleaning costs is contained in a new booklet issued by the **Du Pont Electrochemicals Department.**

★ ★ ★

By use of standard cost factors contained in the booklet, total hourly cleaning costs can be figured rapidly and with reasonable accuracy by inserting basic operating information into simple formulas.

★ ★ ★

Possible economies resulting from the so-called "High-Spot" cost analysis include savings in operating costs of existing cleaning systems as well as selection of the most economical system for new or expanded installations, according to **Jerome J. Hargarten,** solvents service manager for the Electrochemicals Department.

★ ★ ★

"Experience has shown that careful analysis of cleaning costs today can result in cost savings of 25 per cent, or as much as $10,000 annually for a production cleaning installation," Mr. Hargarten said.

★ ★ ★

Du Pont also has developed a more extensive cost analysis booklet containing detailed information for companies desiring a more comprehensive survey of cleaning costs. Both booklets are available through distributors of "Triclene" D trichlorethylene.

New Crane Electrification Booklet

Aluminum Inverted-Y Conductor Systems developed by **The Cleveland Crane & Engineering Co.,** Wickliffe, Ohio, are described in their Electrification Booklet No. 1, just off the press.

★ ★ ★

This covers crane and runway electrification for general industrial usage requiring currents of 500 to 1200 amperes. The equipment includes fittings and current collectors for conductor systems mounted on either wall or ceiling.

★ ★ ★

Electrification Booklet No. 1 will be given free to those interested.

Bulletin on Servo Motors

Bulletin GEA-6381, two pages, discusses design features of totally-enclosed, ball-bearing and full-slot spiral motors designed for fast response to control signals in applications requiring frequent starts, stops, reversals and widely fluctuating loads. Publication contains application information, a chart showing typical motor characteristics, dimension diagrams and conversion formula for the variable speed motors. Write **General Electric Company**, Schenectady 5, N. Y., for a copy of the bulletin.

"Engineering Notebook"

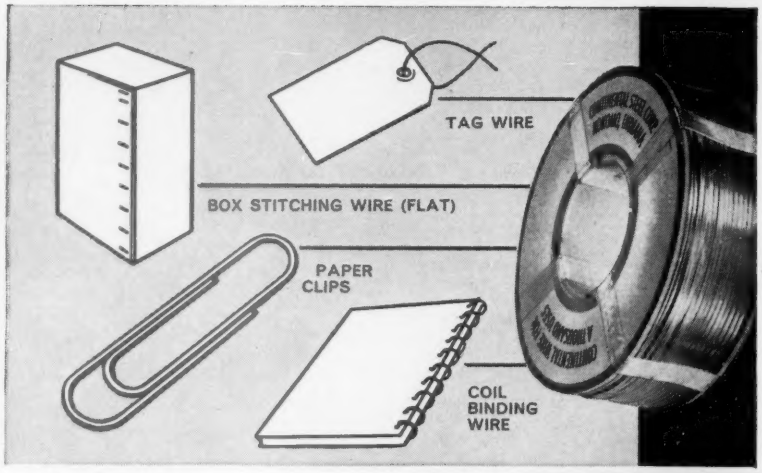
The Western Electric Company held a press preview of a new film, "Engineering Notebook", in September, that was most revealing in its portrayal of the extent to which the company has gone in automating the production of many items of equipment that it manufactures.

★ ★ ★

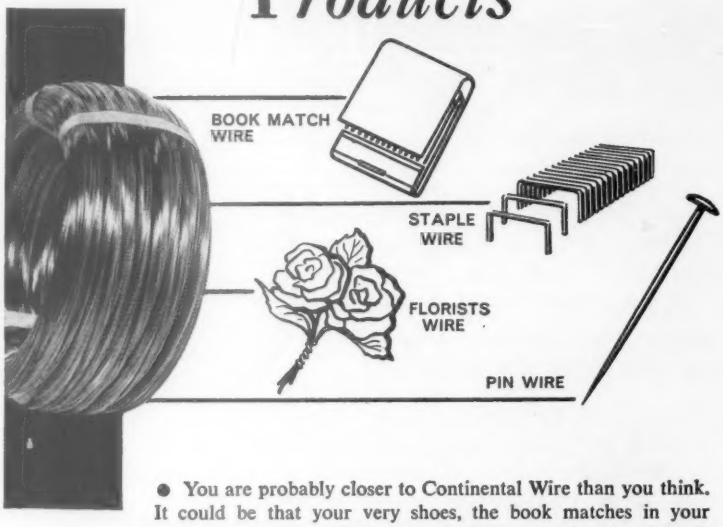
Many products made in various Western Electric plants are comprised of components that are miniature in size and that enter into highly complicated telephone equipment. For the programming and assembly of wires and parts, hundreds of items are prepared and assembled by automatic machines that keep costs down to a point where users can afford to either buy the equipment or buy the service that is rendered by it.

★ ★ ★

Among other things, the film depicted the placing of information on the cards that are fed into IBM electronic computers to be transferred to tapes that control



Fine and Specialty Wire for Super Fine Products



● You are probably closer to Continental Wire than you think. It could be that your very shoes, the book matches in your pocket or the paper clips in your desk—were made using dependable Continental Fine Wire! That's because Continental is preferred by hundreds of leading firms for literally thousands of different fine wire applications. For super fine products—you, too, should try Continental Fine and Specialty Wire, available in many sizes, of almost any temper, finish or analysis, in low carbon and medium low carbon steels.

For the finest in fine wire—call in Continental!

CONTINENTAL

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Wire Specialists for over half a Century

PRODUCERS OF: Manufacturers' Wire in many sizes, tempers, and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, and special shaped wire. Also Welded Wire Reinforcing Fabric, Nails, Continental Chain Link Fence, and other products.

...Why? Because NYECO REELS:

- Are lighter—they lower freight costs.
- Outlast 12 wooden reels—require little or no maintenance.
- Are rugged, weatherproof and splinter proof.
- Warp-proof construction protects costly cable from handling damage.
- Protect your reputation—They insure your cable's safe arrival.

* These leading mills are just a few of the many that use NYECO Steel Reels: ANACONDA, GENERAL CABLE, OKONITE, PHELPS DODGE, ROEBLING, WESTERN ELECTRIC

- *ANY QUANTITY*
- *ANY SIZE*
- *ANY LOAD*
- *FLANGE DIAMETER From 36" UP*

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Specialists to the Wire Industries for Over 45 Years

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operations. This might include stripping of wires, welding into position, testing, rejection of imperfect parts, etc., all of which is done in one machine.

★ ★ ★

Human limitations in such work are the greatest cause of both failures and high manufacturing costs, which has spurred the company to these automatic mechanical methods to achieve uniformity, accuracy and lowered costs in its production methods.

★ ★ ★

The showing was held in Western Electric's new Graduate Engineering Training School in the Coliseum Building in New York City. In the Bell System, the Western Electric Company and the Bell Laboratories are a part of the American Telephone and Telegraph Company. The company employs some 200,000 people, of whom 60,000 are employed in manufacturing and 2,000 in engineering. Western Electric Company does the manufacturing and installation work for the Bell System and the Bell Telephone Laboratories design equipment and engage in research. One of the developments credited to its engineers is the transistor.

Chocks for Large Reels

The McKenzie Engineering Co., Newtown, Conn., has developed what are called "Retracto Chocks" to anchor large reels of cable or other cylindrical objects to freight car or truck floors without damage to floors and to provide a safe, positive anchorage.

★ ★ ★

The chocks may be used over and over and are adjustable to fit any size of reel. They save time, prevent shifting and obviate any possibility of damage to the reels and their contents. For complete information and prices, please write the company.

International Harvester to Erect New Merchant Mill

Roy A. Lingren, Manager of the Steel Division of International Harvester Co., has announced

plans for the construction of a new merchant mill for its Wisconsin Steel Works at Muskegan Ave. and 106th St., South Chicago, Illinois.

★ ★ ★

The mill, which will cost $12,000,000, to be known as No. 6 Mill, will roll small rounds, flats, squares, angles and channels. It will have a capacity of 20,000 tons per month, raising Wisconsin Steel's capacity to 62,000 tons.

New Connectors for Coaxial Cables

A new line of connectors for Phelps-Dodge aluminum sheathed coaxial cables is announced by Edlen Inc., 8105 Woodmont Ave., Bethesda 14, Md.

★ ★ ★

Exclusive design offers the following features:

High mechanical strength and gas tight seal.

Unique design of center contact holds center conductor of cable securely and provides for expansion and contraction. Supporting bead for center contact permits close tolerances to be maintained. Two piece adapter construction minimizes electrolysis problem.

Connectors exceed allowable pulling tension of cables.

★ ★ ★

All installation accessories are available. For further details, ask Edlen Inc., for Bulletin 5-58-EE.

Japanese Firms Merge

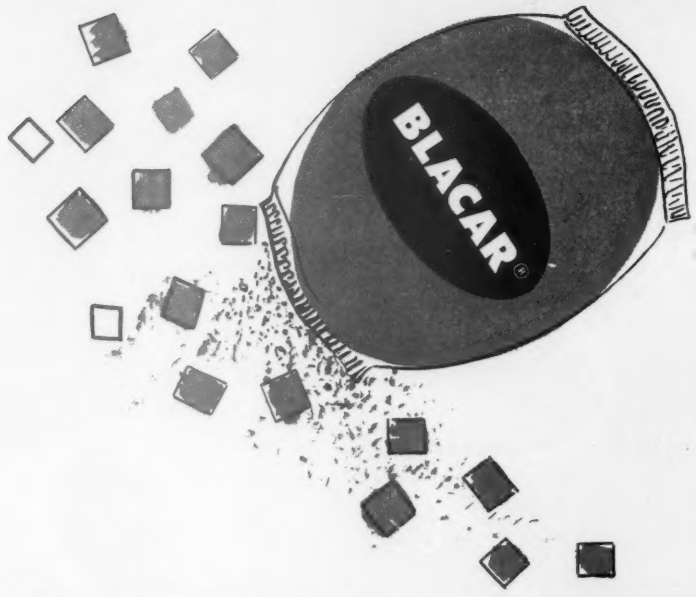
The stockholders of Mitsui Bussan Kaisha, Ltd. and Daiichi Bussan Kaisha, Ltd. have approved the merger of the two firms at stockholders' meetings held on September 19, 1958.

★ ★ ★

The merger becomes effective as of February 15, 1959, after which the new company will operate under the names: Mitsui and Company, Limited, in Europe, Canada and the United States of America and Mitsui Bussan Kaisha, Limited, in other parts of the world.

★ ★ ★

The new company will become Japan's largest trading firm with a capital of approximately US $16,460,000, with fifty-two over-



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PVC RESIN—Blacar #250—**UL-approved for complete interchangeability** in recognized compounds. High Molecular weight—low gel count—excellent dry blending and extrusion characteristics.

Intermediate and low molecular weight resins also available.

PVC COMPOUNDS—In natural, white or black—dry blend or diced:

Blacar #2800—UL-approved for type T and TW wire—oil at 60°C—80°C appliance wire.

Blacar #2700—UL-approved, primary insulation, for type T, TW, TF, TFF wire—oil at 60°C—wide range of low-tension applications.

Blacar #2600—UL-approved for type T, TF, and TFF wire and cable insulation.

Specialists in wire covering—Cary can modify existing formulations or custom-formulate to the most exacting requirements.

Technical assistance, data, or working samples on request.

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Laboratory and Plant: RYDERS LANE, EAST BRUNSWICK, NEW JERSEY
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CARY CHEMICALS PRODUCTS:
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- Vinyl Plasticizers
- Sun Checking Waxes
- Gilsonite Compounds
- High Melting Point Synthetic Waxes

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to give you even better reels!

Due to the ever-increasing demand for our spools and reels, we've had to make our second move in just two years! And in our new and spacious quarters we are manufacturing plywood. Since it's made especially for spools and reels, even better-grade products will result—CARRIS spools and reels, now QUALITY-CONTROLLED from plywood to finished spools and reels!

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INCORPORATED

RUTLAND, VERMONT

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seas offices distributed widely throughout the world, and with some 5,300 offices and employees.

New Hand Press Features Controlled, Positive Action

A new hand press, HP, Jr., featuring controlled, positive action, is now being marketed by **High Speed Hammer Co., Inc.,** Rochester 21, N. Y.

★ ★ ★

HP, Jr., designed for fast, versatile operation, is used for riveting, assembling, forming, stamping, crimping, piercing and all light press operations.

★ ★ ★

Its stroke is ¾″; vertical opening (adjustable), 1″ to 2⅛″; horizontal gap, 1½″; spindle hole for punch, ⅜″ diameter; die space, 3¾″ x 6″; handle leverage, 7″; bench space including handle, 10¼″ x 10″; overall height, 13½″; net weight, 50 lbs.; Shipping weight, 65 lbs.

New D-S High Speed Take-Up

Wire speeds up to 4000 feet per minute are possible on an all-new high speed take-up for insulated wire, now available from **Davis-Standard, Division of Franklin Research Corp.,** Mystic., Conn.

★ ★ ★

The dual reel take-up, Model DR-24HS, is specifically designed for continuous reeling of the lighter gauge wires at speeds up to 4000 feet per minute. Handling reels from 12″ to 24″ in diameter, this D-S take-up features automatic cut-over to the empty reel without any reduction in speed.

★ ★ ★

All operations for loading and unloading of reels are power controlled to eliminate lifting and pushing of reels by the operator. Reels are pneumatically raised and lowered and the pintles on which the reels are mounted also retract and engage pneumatically. A newly-designed friction-disc drive eliminates hunting for dog pin holes during reel loading.

★ ★ ★

Separate dual-motor drive permits the empty reel to be running at exact wire speed during cut-over and a light-inertia guide sheave absorbs wire shock during cut-over. Constant wire tension is adjustable from 2 to 10 pounds pneumatically and traverse is infinitely adjustable for wire lay and width of traverse.

★ ★ ★

Patented wire snaggers are available to provide an adequate, easily-accessible length of the inside end of the wire when desired. Also available is an automatic measuring machine for signalling and/or totalizing of wire footage.

Aluminum Alloy Conductor Standards

Publication 104 of the International Electrotechnical Commission—"Recommendation for an International Specification for Aluminum Alloy Conductor Wire of the Aluminum-Magnesium-Silicon Type"—is now available from the **American Standards Association.**

★ ★ ★

The recommendation applies to aluminum alloy electrical conductor wire containing about 0.5 percent magnesium and about 0.5 percent silicon. The electrical and mechanical properties for this type of wire before stranding are prescribed in the publication.

★ ★ ★

The recommendation was developed by Subcommittee 7-1, Aluminum Alloy, of the International Electrotechnical Commission. The following countries voted explicitly in favor of the publication: Canada, Denmark, France, Germany, Italy, Japan, Sweden, Switzerland, United Kingdom, United States.

★ ★ ★

IEC Publication 104 is priced at 60 cents per copy from the American Standards Association, Dept. PR 21, 70 East 45th St., New York 17, N. Y.

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For Fungus Resistance, Specify

TEXTILENE TWI-TAR

Offering great durability along with light weight, Textilene Twi-Tar is successfully used for buried communication cable (bedding and overall serving), expanded ACSR cable (expander between core and conductors), stationary power cable and portable cables.

Twitchell's superior Textilene line also includes: Moisture-resistant fillers — *Twi-Flex* and *Twi-Wax*. Used for non-metallic sheathed cable, maritime shipboard cable, varnished cambric cable.

Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all types of portable and flexible cords.

*Patent Applied For

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Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation—also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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Outstanding Personalities of the Wire Industry

Wilbur B. Driver Appointment

Wilbur B. Driver Company, melters and manufacturers of precision alloys for all industries, announces the appointment of **Peter Stefan** as Manager Mechanical Alloys.

★ ★ ★

Peter Stefan

Mr. Stefan entered the industry in 1943 as a process metallurgist with the Cleveland Works of Chase Brass and Copper Company, and later became Plant Control Engineer. In 1947, he was employed as Cleveland District Manager by Alloy Metal Wire Company, Inc. of Prospect Park, Pennsylvania. He was subsequently General Sales Manager of Alloy Metal Wire Division, H. K. Porter Company, then Assistant General Sales Manager of Riverside-Alloy Metal Division of that company.

★ ★ ★

He graduated as Metallurgical Engineer from Case Institute of Technology and continued his work on a Research Fellowship and in the Graduate School. He is a member of American Society for Metals, The Wire Association, Copper and Brass Research Association, and American Management Association.

Driver Advances Hallberg to Vice Pres.—Operations

Wilbur B. Driver Company, Newark, N. J., melter and manufacturer of precision alloys for all industries, announces the promotion of **Raymond O. Hallberg** to Vice President in charge of operations.

★ ★ ★

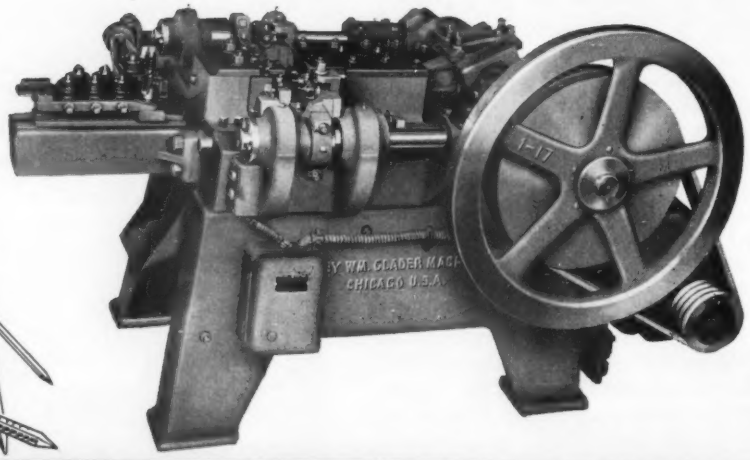
R. O. Hallberg

Glader—Years of Proven Performance

GLADER NAIL MACHINES

55 YEARS of experience meeting the exacting demands of nail making.

The machine with a record of steady dependable service.



Wm. GLADER MACHINE WORKS 210 N. RACINE AVENUE CHICAGO 7, ILLINOIS

EXPORT DEPT. 122 EAST 42nd STREET • NEW YORK 17, N. Y.

Mr. Hallberg started with the company in 1933 as an annealing furnace operator. He has held numerous supervisory positions throughout the company, including Sales Manager and General Superintendent. Before coming to the Wilbur B. Driver Company, Mr. Hallberg was a mechanical engineer for the **Western Electric Company.** He is a member of The Wire Association and the American Management Association.

American Oil Appointments

William O. Holleman has been appointed Sales Manager and **L. W. Schreihofer,** an Administrative Assistant of **American Oil & Supply Co.,** Newark, N. J.

★ ★ ★

Mr. Holleman was formerly Regional Sales Manager of Westvaco Chlor-Alkali Division, Food Machinery and Chemical Corporation, New York City and Mr. Schreihofer, Sales Manager of American Oil & Supply Co., the position taken over by Mr. Holleman. Both appointments were effective October 1st, 1958.

Made Industrial Engineer by Armco

Chester F. Wendt has been appointed works industrial engineer of **Armco Steel Corporation's** Middletown Works, the company's largest plant, D. S. Holstein, works manager, has announced.

★ ★ ★

Mr. Wendt joined Armco at the Middletown plant in 1936 as a laborer. The following year he was transferred to the scheduling department where he held a number of increasingly responsible positions.

★ ★ ★

In 1941, he joined the industrial engineering department at the plant and in 1943 became an industrial engineer. He was promoted to methods engineer in 1945, and assistant works industrial engineer in 1947. He is a graduate of Ohio State University and has done graduate work at that school and the University of Cincinnati.

Firth Sterling Promotes Wellborn

Firth Sterling Inc. announces the appointment of **W. W. Wellborn** as Technical Director, Carbide Division. In his new position, Mr. Wellborn has assumed the responsibility for process metallurgy and the metallurgical aspects of Quality Control in the Carbide Division.

★ ★ ★

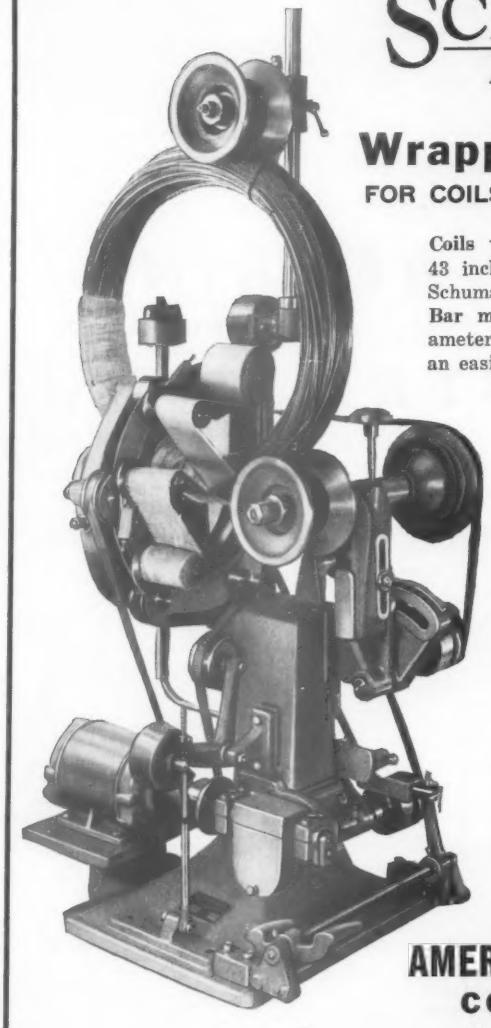
He was formerly Manager of New Products Research, and has served as Technical Advisor of Brassinter S. A. at Sao Paulo, Brazil, the first major domestic producer of cemented carbides in South America.

Beryllium Corp. Creates New Post

The Beryllium Corp., Reading, Pa., has created a new position, Manager, Development Engineering, and promoted Ethan A. Smith, Jr., to it. He joined the company in 1953 as an engineer. The post was set up due to the rapid expansion of the company into new fields. Beryllium Corporation now is a fully integrated company for

SCHUMAG
AACHEN

Wrapping Machine
FOR COILS, BARS AND BUNDLES



Coils with outside diameters up to 43 inches are handled by the basic Schumag WS 2a machine illustrated. Bar material up to 6 inches in diameter is handled by the addition of an easily attached auxiliary device.

Outstanding Features

- Coils, bars and bundles automatically wrapped tightly and smoothly.
- Solidly guided open wrapping ring.
- Precision adjustment of wrapping-band tension. Once set, tension remains constant.
- Adjustable wrapping pitch. Special ranges available on order.
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the production of beryllium from ore to finished alloys and products, many of these products going into the nuclear, aircraft, missile, and electronic industries.

Scovill Elects President

Selden T. Williams has been elected president of **Scovill Manufacturing Co.,** Waterbury, Conn., replacing William M. Goss, who retired. Mr. Williams had been general manager of Scovill's A. Shrader's Son Div.

★ ★ ★

The election of Mr. Williams is the first time in over 50 years that a member of the Goss or Sperry family has not held the office of chief executive. **Mark L. Sperry, 2nd,** will continue as executive vice president. Leavenworth P. Sperry's resignation as chairman of the board was also announced recently. Both Mr. Sperry and Mr. Goss will remain on the board, the chairmanship of which for the moment is vacant.

Named to Industrial Controls Post

Appointment of **Martin J. Sherry** to the industrial controls division of **General Controls Co.,** as account executive, has just been announced by **J. F. Ray,** vice-president, sales.

★ ★ ★

He was formerly mechanical and project engineer with the Corps of Engineers and other military departments specializing in filtration, refrigeration and air conditioning equipment, controls and instrumentation. Prior to that he was a field engineer with Belco Industrial Equipment Co. He holds a Bachelor of Engineering degree from the University of Southern California.

★ ★ ★

New duties will be assumed at the Glendale, Calif., headquarters of the firm, which manufactures automatic pressure, temperature, level and flow controls.

Appointed V.P.— Technical Service

To further advance their technical and sales leadership in the high temperature wire and cable industry, **George W. Heller** has been appointed Vice President for Technical Service and Sales by **Tensolite Insulated Wire Co., Inc.,** Tarrytown, N. Y.

★ ★ ★

Mr. Heller has been serving the high temperature wire and cable industry in various engineering, sales and management capacities. He received his B. S. degree in Chemical Engineering in 1947 from Columbia University, and his M. S. degree in 1948 from the same university. For five years he was associated with the E. I. DuPont DeNemours Company in research, development, and sales service.

★ ★ ★

Previously, Mr. Heller spent four years with Tensolite as a

ROLLER BEARING

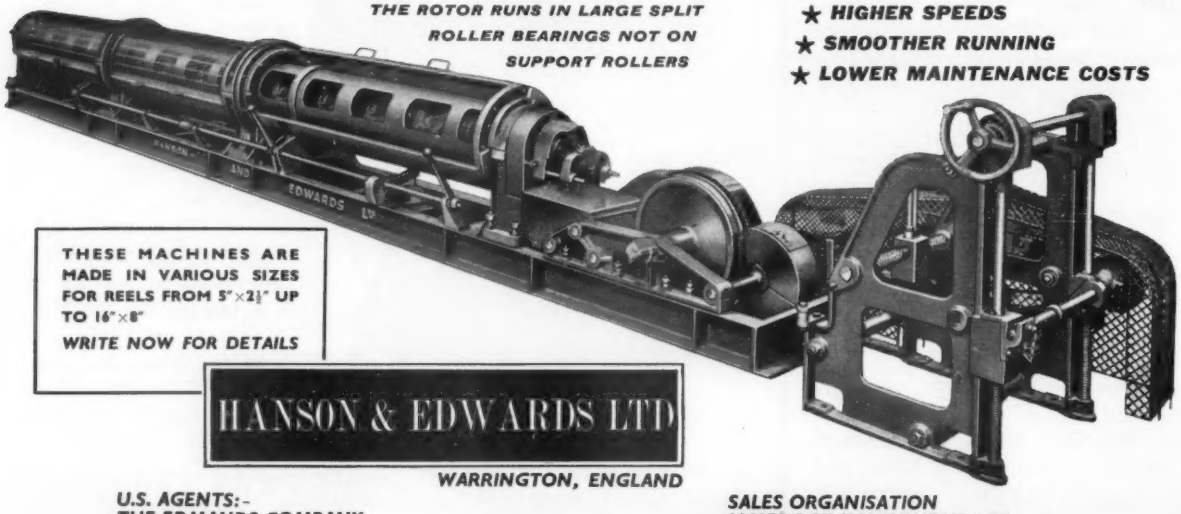
TYPE TUBULAR

STRANDING MACHINE

(EITHER SINGLE OR DOUBLE CAPSTAN)

THE ROTOR RUNS IN LARGE SPLIT ROLLER BEARINGS NOT ON SUPPORT ROLLERS

★ *HIGHER SPEEDS*
★ *SMOOTHER RUNNING*
★ *LOWER MAINTENANCE COSTS*



THESE MACHINES ARE MADE IN VARIOUS SIZES FOR REELS FROM 5"×2½" UP TO 16"×8"
WRITE NOW FOR DETAILS

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P 1686

product development engineer and later as Sales Manager. Most recently he has been associated with the Thermax Wire Corporation, New York City, as General Manager.

Wire Industry Gets New Consultant

Ralph K. Clifford, who recently retired as chairman of the Board of the Continental Steel Corporation, but who is still a director, has advised that he has established a consulting firm, Tyred and Rhee, of which he is Chairman, President and General Manager. The firm is a "Consultant in Geriatrics," old age and its diseases to you, good reader.

★ ★ ★

Activities will be conducted under the motto "Nolle Illegitemi Carborundum," which is loosely translated, Ralph explains (with apologies to Bill Akin) as: "Don't let the bastards grind you down." The consulting services will be conducted, according to the season, from two addresses: 2510 N.E. 14th St., Ft. Lauderdale, Fla., and 415 E. Sycamore St., Kokomo, Ind.

★ ★ ★

Ralph K. Clifford
Consultant in Geriatrics

Mr.—or should it now be "Doctor"—Clifford will be pleased to furnish a business card to interested parties.

Director of Research Appointed

Apex Tire & Rubber Co. of Pawtucket, R. I., announced the election of **Markus D. Royen** as Vice President and Director of Research.

★ ★ ★

Dr. Royen obtained his early education in Poland, and advanced training in the Institute of Technology in Danzig, Germany, where he received his diploma in Chemical Engineering. He took additional technical courses abroad and in this country in Rubber and Plastics.

★ ★ ★

His first association here was with H. O. Canfield in Bridgeport, Connecticut, where he worked in the research on synthetic rubbers, which were then in the early

When in Rhode Island, visit our new, ultra-modern plant at 100 Glen Road, Cranston.

EVERYTHING IS ALL NEW AT 100 GLEN ROAD!

For forty years, many of the important advances in equipment for the Wire Industry have originated at the James L. Entwistle Company.

Now, in our brand-new air conditioned factory, many new concepts in the handling and processing of wire have been incorporated in revolutionary machinery that makes previous equipment and methods obsolete. In today's competitive market, only the most modern plants will capture the cream of the business and enjoy a favorable profit margin.

The James L. Entwistle Company has ready, *right now,* the equipment to help put your firm in the lead!

- A.C. AND D.C. "CONTROLLED POWER"* SPARK TESTERS
- COMPLETELY AUTOMATIC RE-REELER-SPARK TESTERS
- HIGH SPEED, 5,000 F.P.M., 1½ LB. TENSION RE-REELERS
- AUTOMATIC DOUBLE-HEAD COILER SPARK TESTERS
- "FOG-BANK" ELECTRODE UNITS*
- PRINTING-TYPE FAULT AND REEL RECORDERS
- OPEN-SIDE MEASURING MACHINES
- SHAFTLESS TAKE-UPS
- PAY-OFF REEL STANDS
- BALL SCREW TRAVERSES
- "JET-STREAM" SPIRAL STRIPING MACHINES*
- WIRE MARKING WHEELS AND TYPE STRIPS
- WIRE MARKING INKS

** PATENT APPLIED FOR*

ASK FOR COMPLETE DATA

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SPARKING THE WIRE INDUSTRY SINCE 1918

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ENGLAND
General Engineering Co. (Radcliffe) Ltd.
Station Works — Bury Road
Radcliffe, Lancashire, England

stages. He joined Apex Tire & Rubber Co. in 1945. Apex Tire & Rubber Co. manufactures tire repair materials, shoe soling materials, vinyl compounds, and garden hose, at plants in Pawtucket.

Louis Winkler Retires

The retirement on September 30 of **Louis H. Winkler,** metallurgical engineer with **Bethlehem Steel Company,** has been announced by **E. F. Martin,** Vice President.

★ ★ ★

Mr. Winkler's career has been distinguished by many notable contributions to the science of metallurgy. He has given generously of his talents to many scientific and professional organizations, in recognition of which he was presented in 1956 with the University of Missouri Honor Award for Distinguished Service in Engineering, and in the same year with the American Petroleum Institute Citation for Service.

★ ★ ★

Much of Mr. Winkler's work has been in rails, wheels and railroad products, wire and wire products, and piping and tubular products. For many years he has been actively engaged in the work of the American Society for Testing Materials. He is at present an honorary member of the society, which he served as a director from 1946 through 1949.

★ ★ ★

He has been a member of **The Wire Association** for many years and was the Mordica Memorial Lecturer in 1942, his lecture being entitled "Steel and Wire". He is also a member of ASM, SAE, AREA and AISI.

★ ★ ★

Born in Carthage, Mo., he received his B.S. degree at the University of Missouri in 1907 and his M.E. degree at the same university in 1909. After graduation he became associated with Cambria Steel Company, at Johnstown, Pa., remaining with Cambria through its consolidation with Midvale Steel and Ordnance Company and its later acquisition, in 1923, by Bethlehem Steel.

W. E. Appoints Director of Research

Glen R. Simmons, who has held engineering, development and production posts with the **Western Electric Company** for twenty-one years, has been appointed director of research and development at the Western Electric Engineering Research Center, Princeton, N. J.

★ ★ ★

Mr. Simmons assumed his new duties on October 1. He was formerly superintendent of manufacturing engineering at Western Electric's Hawthorne Works, in Chicago. He joined the Bell system's manufacturing and supply company in 1937 and has done considerable work in developing manufacturing processes and materials. He is responsible for a number of patents in these fields. He graduated from the University of Chicago with bachelor of science degree in 1936 and received a doctorate in 1942.

★ ★ ★

Mr. Simmons succeeds the late

PLYMKRAFT CABLE FILLER

TREATED TO MEET YOUR MOISTURE, STRENGTH AND FUNGI REQUIREMENTS

Just name the type treatment—such as wax, jute saturant, anthracene—to meet your moisture and fungi control requirements, and see the difference Plymkraft can make. Plymkraft is made to fit your particular standard of manufacturing. Its greater fill capacity, greater uniformity, save you time and money in a better looking cable. Smooth running Plymkraft is also ideal for high-speed cablers where extra strength is a must. Use Plymkraft Cable Filler for cleaner, more efficient cabling.

To keep up to date with the latest cable filler developments, it takes only an inquiry for samples of Plymkraft. To find the quality cable filler best suited for your wire needs, write today to:

PLYMKRAFT DIVISION
PLYMOUTH CORDAGE COMPANY
Plymouth, Massachusetts

Raymond P. Lutz, who died on August 30 following a heart attack.

Elects Manager

Thompson Chemical Company has announced the election of **Victor J. Baxt** to the office of Vice President and General Manager of the company.

★ ★ ★

Mr. Baxt received his B. S. in Chemistry at the University of Rhode Island in 1938 and was awarded the degree of M. A. in Chemistry by Duke University in 1940. In 1944 he took special courses at Princeton and M. I. T.

★ ★ ★

Thompson manufactures polyvinyl chloride resins, plasticizers for the plastic industry, and automotive chemicals. It operates plants at Pawtucket, R. I., and Hebronville, Mass.

Elgin Names New Sales Engineer

The Abrasives Division of the **Elgin National Watch Company** announces the appointment of **Forrester B. Svendsen,** as sales engineer in New York State and Northwestern Pennsylvania.

★ ★ ★

William H. Baudouine, Division Sales Manager, said the addition of Forrester Svendsen will provide an increased engineering service for customers in this area. His address is 1 Groveland Road, Geneseo, N. Y.

★ ★ ★

The Abrasives Division markets a complete line of industrial diamond abrasives, diamond grinding wheels, carbide rotary tools, and Elgiloy, a spring material.

New Rockbestos Appointments

John F. S. Abbott has been appointed director of research and development of **Rockbestos Products Corporation,** it was announced by **Albert S. Redway,** Rockbestos president. Rockbestos manufactures insulated electrical wires and cables.

★ ★ ★

At the same time, Rockbestos Works Manager **Alexander S. Basil** announced the formation of a new department at Rockbestos to be called Production Engineering. It will be under the direction of **James F. McClelland, Jr.,** as manager, assisted by **David Chaffin.**

★ ★ ★

Mr. Abbott comes to the company from Kaiser Aluminum and Chemical Corp. at Bristol, R. I., and prior to that had been with U. S. Rubber Co. for 15 years. He is a Yale graduate and took post-graduate work at Columbia and Rhode Island Universities.

Mr. McClelland was technical director of the company before this appointment. He is also a graduate of Yale University and holds a master's degree from M.I.T. Mr. Chaffin, formerly a methods engineer, is a graduate of M.I.T.

DuPont Appoints Service Manager

Jerome J. Hargarten has been appointed service manager of the Chlorine Products Division for the **Du Pont Company's Electrochemicals Department.**

NILSON 4-SLIDES FORMING PRODUCTION PROFITS... *Automatically*

COMBINE OPERATIONS on a NILSON

Wire and ribbon metal forms involving secondary operations can be produced at minimum cost on Nilson 4-Slides. You can combine stamping, welding, metal cutting and sub-assembly operations with the basic forming cycle . . . eliminate the need for expensive, single-purpose equipment.

The Nilson "Vertiform" shown above, for example, has a die head mounted on the right-hand forming slide. Wire stock is straightened, cut off, formed and threaded—all automatically in one cycle!

In addition to the new "Vertiform," Nilson builds 17 models of horizontal 4-slides, including 5 ribbon metal machines with built-in press units. For a new approach to low-cost production of wire forms and small metal stampings, it will pay you to get in touch with Nilson.

Send today for the Nilson General Catalog on Automatic 4-Slide Equipment!

NILSON
THE A. H. NILSON MACHINE CO.
1506 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

He will direct activities of solvents technical representatives here and will coordinate metal cleaning work in the field and at the new Electrochemicals Department's Sales Technical Laboratory at Chestnut Run.

★ ★ ★

Mr. Hargarten joined Du Pont in 1950 as a development engineer. He has held various technical positions, including technical service representative for chlorine products in the Detroit area. In his new post he succeeds **Frederick G. Low**, recently appointed product manager for lysine.

E. G. Pickering

The Directors of **Johnson Matthey & Co., Ltd.**, London, England, announce with deep regret the death of their colleague, E. G. Pickering, a joint managing director of the company, who had been active in its affairs for over forty years. Mr. Pickering was a member of The Wire Association.

Maurice Avison

Maurice Avison, Chairman and Managing Director of Ramsdem Camm & Co., Ltd., Brighouse, Yorks, England, passed on in July.

★ ★ ★

He commenced his business career as an office boy, although it was not long before he founded the firm of Maurice Avison Limited, Cleckheaton, along with his brother, to deal in wire shorts, scrap and other metallic residuals from the wire trade.

★ ★ ★

In 1927 Mr. Avison was elected to the Board of this Company as Managing Director at a time when the Company were experiencing a critical phase in its long history. Through his efforts, he was able to reestablish the firm to its former position in the wire trade. At the time of his death Mr. Avison was still Managing Director, and had also held the position of Chairman for over 15 years.

He began to take an active part in the affairs of Bamford Spring Interiors Limited in 1950, and was also Chairman of that Company up to the time of his death.

★ ★ ★

Mr. Avison was a prominent member of the various Trade Associations connected with his business interests, being an Executive Committee member of the Institute of Iron & Steel Wire Manufacturers, the Patented Steel Wire Association and the Spring & Spring Interior Association. He also sat on many other committees, and played a leading part in the many deliberations which took place on behalf of the Independent Wire Manufacturers.

You Are Invited To Join

THE WIRE ASSOCIATION

Send for booklet describing its activities and a membership application card.

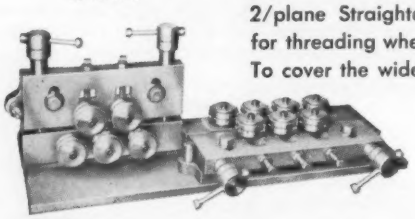
453 Main St. Stamford, Conn.

Sjogren 2 PLANE **ROLL STRAIGHTENERS**

RIGHT HAND
For Wire
Diameter
1/16-1/8"

Sjogren Two Plane Roll Straighteners are fully ball bearing for heavy production duty. They are designed to accommodate all sizes and grades of round or shaped wire whether it be high carbon, low carbon or copper, as well as the many alloys, from .010" to .375". Once set for the job at hand Sjogren 2/plane Straighteners may be opened and closed for threading when making coil changes without effecting the adjustment of the setting. To cover the wide range of wire diameters there are several size groups manufactured with either left or right hand direction. Each is individually produced to exact specifications for the grade, size and type of wire to be processed. Sjogren Two Plane Roll Straighteners do their duty each day, every day in the year.

LEFT HAND
For Wire Diameter
3/16-3/8"



Sjogren SINCE S&S 1927
TOOL & MACHINE CO., INC.

WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • CAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS

Used by Wire Men Who Want the Best!

14 SWORD ST. • AUBURN, MASS.

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.
Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50c for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,849,840, METHOD AND APPARATUS FOR GRINDING NAIL CUTTER DIES, patented September 2, 1958 by Albert L. Stoeckel, Euclid, Ohio, assignor to United States Steel Corporation, a corporation of New Jersey.

This apparatus is for cutting dies having wire-cutting edges and shaping surfaces which intersect at a common point. There are 12 claims.

★ ★ ★

No. 2,851,037, WIRE FORMS FOR BRASSIERES, patented September 9, 1958 by Virginia S. Johnson, Los Angeles, Calif.

The invention provides an endless rigid wire member formed to provide a smoothly-curved generally horseshoe-type arch and a second rather shallow smoothly curved segmental arch disposed in a plane normal to the plane of the first arch.

★ ★ ★

No. 2,851,087, AUXILIARY FURNITURE SPRING, patented September 9, 1958 by Edwin G. Krakauer, Roslyn Heights, N. Y., assignor to Kay Manufacturing Corporation, Brooklyn, N. Y., a corporation of New York.

A spring structure is disclosed including a frame, a border wire, a sinuous wire spring bridging the frame, an auxiliary spring of generally O-shaped outline for and confined to the sinuous spring, the auxiliary spring having a continuous bent rear end portion adapted to be hooked to and thereby rigidly connected solely by the end portion to the sinuous spring.

★ ★ ★

No. 2,851,088, SPRING STRUCTURE FOR UPHOLSTERED FURNITURE, patented September 9, 1958 by Walter M. Pietruszka, Brooklyn, N. Y., assignor to Kay Manufacturing Corporation, a corporation of New York.

The wire spring is provided with cantilever end portions and a support which enables the intermediate portions and the cantilever end portions to yield independently of each other upon the loading of the spring.

★ ★ ★

No. 2,851,089, LOCKABLE UPHOLSTERY EDGE SPRING, patented September 9, 1958 by Walter M. Pietruszka, Brooklyn, N. Y., assignor to Kay Manufacturing Corp., Brooklyn, N. Y., a corporation of New York.

A clipless and jointless O-shaped auxiliary spring of a single length of wire is employed, provided with S-hooks associated with cross bars and a zig-zag wire spring structure.

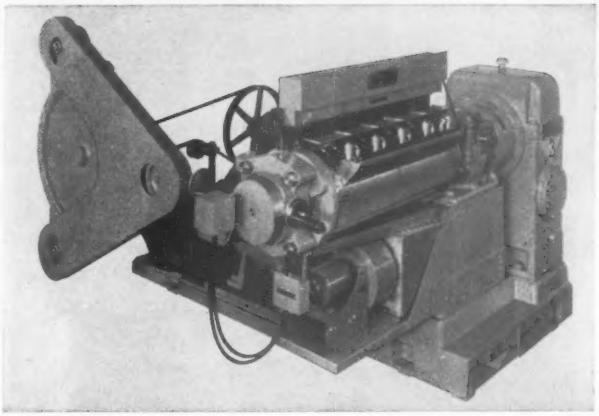
★ ★ ★

No. 2,853,202, WIRE CARRYING CASE FOR GLASS BOTTLES, patented September 23, 1958 by Donald R. Swingle, Chattanooga, Tenn., assignor to Cumberland Case Company, Chattanooga, Tenn., a corporation of Tennessee.

Rectangular wire is employed for the main frame portions of this case with other wires connecting the main frame portions, and stacking elements extending above the corners of the top frame wire in a position to be disposed inwardly of the corners of the bottom frame wire and below the bottom of a like case when the latter is mounted in stacked relation thereon so as to retain the like case in stacked relation.

★ ★ ★

No. 2,854,034, SPRING COIL FEEDING MECHANISM, patented September 30, 1958 by Charles C. Waful, South



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For Maximum Versatility

Whether you are extruding plastics that require high processing temperatures or quick-curing compounds Royle Spirod —the all purpose, all-electric, completely automatic extruder —provides positive temperature control. This versatility is the result of combining a proportioning controlled system of high velocity evaporative cooling with tubular resistance heating to supply constant, accurately zoned processing temperatures.

Send for Bulletin Number 463

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England — James Day (Machinery) Ltd. — Hyde Park 2430 - 0456
Home Office — V. M. Hovey J. W. VanRiper — SHerwood 2-8262
Akron, Ohio — J. C. Clinefelter Co. — BLackstone 3-9222
Downey, Cal. — H. M. Royal, Inc. — TOpaz 1-0371
Tokyo, Japan — Okura Trading Co., Ltd. — (56) 2130 - 2149

Gate, Calif., assignor to Spring Machinery Company, Los Angeles, Calif., a corporation of California.

For a machine for assembling a spring unit formed of a number of rows of wire spring coils tied together with helical connector devices there are provided to advance the rows of coils to helix-connecting positions, with some of the devices having resiliently-propelled coil-pushing mechanisms.

★ ★ ★

No. 2,854,036, WIRE TWISTING DEVICE, patented September 30, 1958 by Gustave C. Sobocinski, Chicago, Ill., assignor to General Telephone Laboratories, Incorporated, a corporation of Delaware.

The wire twister includes a motor-driven shaft, a second shaft mounted in bearings and having wire-attaching devices and a spiral spring positioned there-around and engaging a chuck, and a normally-closed electric switch connected with the motor and operated by the spring; when tension is applied to the wires, the second shaft will move longitudinally against the spring to allow the switch to close and to engage the clutch to effect rotation of the shafts and thereby twist the wires.

★ ★ ★

No. 2,854,066, CUSHION SPRING, patented September 30, 1958 by Huot W. Sternberg, Bridgeport, Conn., assignor, by mesne assignments, to Nachman Corporation, Chicago, Ill., a corporation of Illinois.

Upwardly-tapered coiled wire springs in rows are associated with filler springs of heavier gauge wire, with the axes of the two kinds of springs staggered and the filler springs mounted over the tapered springs so that upon compression of the spring construction the tapered springs are blocked by the convolutions of the coiled springs and prevented from assuming a reversed taper and entering between the convolutions of the coiled springs.

★ ★ ★

No. 2,854,074, COMPOSITE ELECTRICAL CONDUCTOR AND METHOD AND APPARATUS FOR PRODUCING SAME, patented September 30, 1958 by William H. Frank and Elwood T. Platz, Detroit, Mich., assignors, by mesne assignments, to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania.

A composite die is disclosed comprising first, second and third die members, devices forming aligned first, second and third openings in the die members respectively, the second opening having a rounded peripheral edge at the upper portion thereof, devices for receiving and supporting a metal stock member between the first and second die members and over and against the adjacent edge of the second opening, devices for receiving and supporting another metal stock member between the second and third die members and over and against the adjacent edge of the third opening, and a punch receivable through the first opening and into the second opening to punch an insert from the first named stock member through the second opening and into and through the second named stock member to dispose the insert into the second named stock member.

★ ★ ★

No. 2,854,639, ELECTROMAGNETIC DELAY CABLE AND MANUFACTURE THEREOF, patented September 30, 1958, by Henry G. Nordlin, Livingston, N. J., assignor to International Telephone and Telegraph Corporation, a corporation of Maryland.

The cable comprises an insulated conductor in the form of a uniform diameter closely wound coil of insulated wire, a metallic conductor surrounding this coil, a thin semi-conductive coating intimately bonded to the entire outer surface of the insulation of the insulated conductor, and a tightly fitting tubular layer disposed between the coil and this metallic conductor comprising an electrically conductive plastic composition in close contact with both the coating and the metallic conductor.

Canadian Wire Manufacturer Sold to U.S. Firm

Universal Products Company, Inc. has announced the acquisition of industrial Wire & Cable, Ltd., of Toronto, Canada, in a $3 million all-cash transaction.

★ ★ ★

(ILLUSTRATED)
42" x 20" x 21"—(4000# cap.)

HEAVY DUTY
BREAK-DOWN REELS

1000#
2000#
4000#
} capacities

Rugged Design including patented DURA-CURL rim, and many other features necessary to provide the *Strength* and *Durability* needed for continued successful performance.

Also complete line of sizes of Modern High Speed Wire Drawing NO-CREV Spools and Reels for both fine and intermediate size wire.

Mossberg PRESSED STEEL Corporation
"Division of Wanskuck Co."
18 WEST ST., ATTLEBORO, MASS., U.S.A.

Telephone
Attleboro 1-0848

#103

The announcement was made by **M. Mac Schwebel,** Universal president, after a special stockholders meeting at which it was voted to change the Universal corporate name to Universal Controls, Inc.

★ ★ ★

Industrial Wire & Cable, founded in 1937, markets more than 75 product lines, including aluminum and copper wire coated with polyethylene, PVC, asbestos and fabrics.

Apex Line To Be Put Out in New Drums

Celebrating its 25th Anniversary Year of supplying the Wire Drawing Industry with drawing lubricants and cleaning and coating compounds, the **Apex Alkali Products Company** of Philadelphia, Pa., is introducing a newly designed, protectively-lined container for its products.

★ ★ ★

This attractive new container is lithographed in red and white with the company's well-known trademark. The step is in keeping with Apex Alkali's determination to supply customers with the best possible products in a container that will be distinctive in appearance and easy to identify.

New Apex symbol for their new red and white containers.

New Coating for Drawing Stainless Steel

Amchem Products, Inc., Ambler, Pa., (Formerly American Chemical Paint Co.), announces their latest development known as Serseal No. 32 Process for use with their "Granodraw" SS Process, which produces oxalate coatings on stainless steel to facilitate drawing.

★ ★ ★

Serseal No. 32, designed especially for the "Granodraw" SS Process, produces a di-phase bath, reduces normal loss of unstable chemicals usually found in this type of process by approximately 50%, while reducing normal heat requirements for the operation by approximately 75%.

★ ★ ★

Ten production "Granodraw" SS baths are now operating utilizing the new Serseal No. 32—many for six months or more. Patents have been applied for, covering the Serseal No. 32 Process.

AMERICAN IRON AND STEEL INSTITUTE
150 EAST FORTY-SECOND STREET, NEW YORK 17, N. Y.

AIS 10

AUGUST - 1958
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

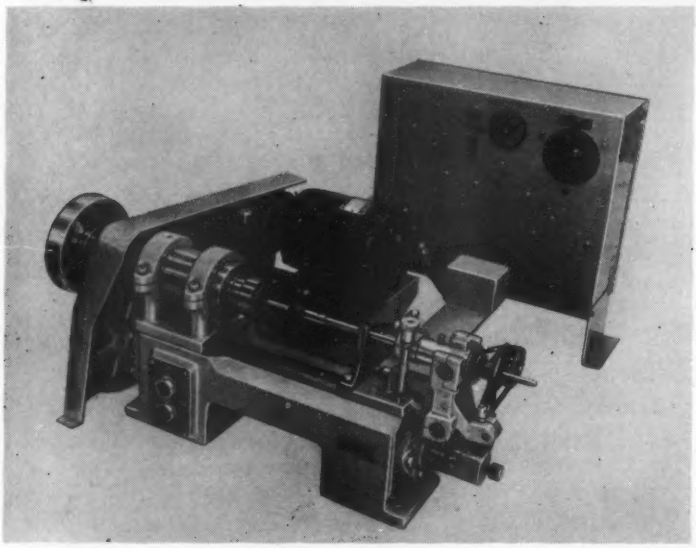
Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

Steel Products	Items	CURRENT MONTH 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments	YEAR TO DATE * 1958 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1957) Percent of Total Shipments
Ingots and Steel Castings	1A	11,569	8,158	630	20,357	0.4	0.7	85,810	75,183	13,238	174,231	0.5	0.6
Blooms, slabs, billets, sheet bars	1B	53,626	23,700	1,457	78,783	1.6	2.5	503,611	178,009	10,499	692,119	1.8	3.2
Tube rounds	1C	724	131	27	882	-	-	4,625	1,328	49	6,002	-	0.1
Skelp	2	9,215	-	-	9,215	0.2	0.1	63,848	-	-	63,848	0.2	0.2
Wire rods	3	65,269	908	547	66,724	1.4	1.1	520,259	7,680	3,617	531,556	1.4	1.2
Total Semi-Finished		140,403	32,897	2,661	175,961	3.6	4.4	1,178,153	262,200	27,403	1,467,756	3.9	5.3
Bars—Hot rolled (incl. light shapes)	14	359,902	92,429	2,706	455,037	9.4	9.1	2,729,956	647,911	21,583	3,399,450	9.1	9.6
Bars—Reinforcing	15	180,030	-	-	180,030	3.7	3.0	1,362,869	-	-	1,362,869	3.6	3.0
Bars—Cold finished	16	64,392	10,994	3,473	78,859	1.7	1.6	506,542	81,702	26,560	614,804	1.6	1.6
Tool steel	17	711	4,854	-	5,565	0.1	0.1	5,302	38,325	-	43,627	0.1	0.1
Total Bars and Tool Steel		605,035	108,277	6,179	719,491	14.9	13.8	4,604,669	767,938	48,143	5,420,750	14.4	14.3
Wire—Drawn	23	193,592	2,346	1,710	197,648	4.1	3.2	1,470,621	19,098	13,602	1,503,321	4.0	3.2
Wire—Nails & staples	24	37,564	-	1	37,565	0.8	0.6	292,644	-	11	292,655	0.8	0.6
Wire—Barbed & twisted	25	3,382	-	-	3,382	-	-	44,661	-	-	44,661	0.1	0.1
Wire—Woven wire fence	26	3,561	-	-	3,561	0.2	0.1	126,038	-	-	126,038	0.3	0.3
Wire—Bale ties & baling wire	27	3,795	-	-	3,795	0.1	0.1	50,670	-	-	50,670	0.1	0.1
Total Wire & Wire Products		247,914	2,346	1,711	251,971	5.2	4.0	1,984,634	19,098	13,613	2,017,345	5.3	4.3
Sheets—Hot rolled	31	455,630	16,226	2,472	474,328	9.8	8.8	3,501,858	135,409	18,404	3,655,671	9.7	9.7
Sheets—Cold rolled	32	786,085	3,721	9,825	799,631	16.6	14.5	5,809,509	22,970	69,964	5,902,443	15.7	13.9
Sheets—Galvanized	33	253,259	4	-	253,263	5.2	3.0	1,759,583	4	-	1,759,587	4.7	2.9
Sheets—All other coated	34	16,239	-	-	16,239	0.3	0.2	104,408	-	-	104,408	0.3	0.2
Electrical sheets & strip	35	1,875	30,447	-	32,322	0.7	0.7	21,016	256,158	-	277,174	0.7	0.8
Strip—Hot rolled	36	85,051	1,413	698	87,162	1.8	1.7	580,527	10,571	4,861	595,959	1.6	1.7
Strip—Cold rolled	37	65,053	2,387	13,417	80,857	1.7	1.5	484,411	16,013	88,628	589,052	1.6	1.4
Total Sheets and Strip		1,663,192	54,198	26,412	1,743,802	36.1	30.4	12,261,312	441,125	181,857	12,884,294	34.3	30.6
Total Shipments (1958)		4,543,610	251,248	40,165	4,835,023	100.0	xxx	35,304,065	2,013,814	309,491	37,618,370	100.0	xxx
Total — Prior Year (1957)		5,832,324	352,974	44,555	6,229,853	xxx	100.0	52,625,530	2,320,716	446,468	56,392,714	xxx	100.0

*Revised.

92958

Look—"Super!" NO HANDS



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Automatic Polisher

From rough lapping to polishing and finishing the Die remains in the machine. No changing of belts or pulleys.

Uses 110 volt AC — 50 or 60 cycle

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17 Grove Street, Montclair, N. J. (Newark suburb)
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Manufacturers of Wire Die Finishing Machines • Polishers • Drillers • Lapping Machines • Pin Grinders • Heavy Duty Ripping Machines • Shaped Die Machines

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UPTON, BRADEEN & JAMES, LTD.
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Toronto 5, Ontario, Canada

Or ask your die supplier

J. T. COPPICK IND., LTD.
377 Munster Avenue
Toronto 18, Ontario, Canada

COPPER - Consumption of refined copper in the United States, June-July 1958, in short tons

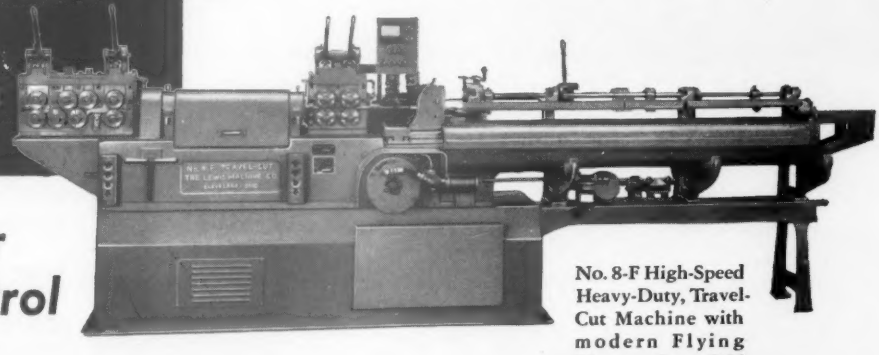
	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
June:						
Cathodes	353	7,620	(3)	24	(3)	7,997
Wire bars	63,905	2,984	(3)	-----	(3)	66,889
Ingots and ingot bars	785	4,862	(3)	261	(3)	5,908
Cakes and slabs	-----	8,236	(3)	2	(3)	8,238
Billets	-----	14,314	(3)	-----	(3)	14,314
Other	60	-----	(3)	38	(3)	98
Total	65,103	38,016	(4)	325	(4)	4/106,444
July:						
Cathodes	170	6,452	(3)	38	(3)	6,660
Wire bars	38,745	2,946	(3)	-----	(3)	41,691
Ingots and ingot bars	794	5,385	(3)	149	(3)	6,328
Cakes and slabs	-----	7,631	(3)	-----	(3)	7,631
Billets	-----	11,324	(3)	-----	(3)	11,324
Other	30	-----	(3)	14	(3)	44
Total	39,739	33,738	(4)	201	(3)	4/76,678

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 3,000 tons included in total.

WIRE STRAIGHTENING AND CUTTING with Air Clutch and Air Brake

for better quality control

• Greater accuracy with a minimum of spot swell is achieved through three important improvements on the famous Lewis Travel-Cut Wire Straightening and Cutting Machines . . . Wichita Air Clutch and Brake and Reeves Variable Speed Drive. There are 34 models in the Lewis line from .012" to ¾" rounds and shapes at speeds up to 200 FPM. Write for new brochure.



No. 8-F High-Speed Heavy-Duty, Travel-Cut Machine with modern Flying Shear Cut-Off Mechanism. Handles 5/32" to 3/8" dia. wire at speeds up to 200 FPM.

THE LEWIS MACHINE COMPANY

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Only Ludlow offers a Complete Spiralwrap Service!

Get the paper *and the machines and devices* for every spiral-wrapping need from the *one* reliable source that also offers experienced field service — Ludlow!

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Waxed Creped Kraft;
Plain and Reinforced
Creped Asphalt Duplex;
VPI (Anti-Rust) Papers;
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PACKAGING PAPERS DIVISION
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ROD BAKERS

Faster baking, greater fuel economy, maximum production efficiency are just a few of the results of the exclusive heating arrangement of the Carl Mayer Hi-Speed Rod Baker. It also has a patented blow-off feature which removes moisture without damage to coils.

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Crucible Steel Co. of America
Driver-Harris Co.
B. Greening Wire Co., Ltd.
Indiana Steel & Wire Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
Sheffield Steel Div., Armco Steel Corp.
Steel Company of Canada

Write for Bulletin No. 350

Patent Nos.
U. S. A. 2,296,361
2,323,828
2,235,559
Canada 396,144
401,589

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20800 CENTER RIDGE RD., CLEVELAND 16, OHIO
OTHER PRODUCTS: Core Ovens • Mold Ovens • Welding Rod Ovens • Heat Treating Ovens & Furnaces • Special Processing Equipment and Accessories.

Strand for Pre-Stressed Concrete

Production of high-strength, stress-relieved, 7-wire strand for use in pre-stressed concrete construction has now been started at the Sparrows Point plant of **Bethlehem Steel Company.**

★ ★ ★

The new equipment installed will stress relieve the strand by induction heating rather than by the conventional hot-air or lead bath.

★ ★ ★

The mill is favorably located for prompt shipments to every part of the country, including the Pacific Coast, and for export shipments.

Rex Corporation Offers to Acquire Assets of Ansonia

A conditional proposal for purchase of operating assets of The **Ansonia Wire & Cable Company,** Ashton, R. I., by **The Rex Corporation** of West Acton, Mass. was announced jointly yesterday by **Emmett G. Gardner,** Chairman of Ansonia's Board, and **Gilbert E. Bell,** President of Rex.

★ ★ ★

In the event that the proposed transfer is approved by Ansonia's stockholders and carried through to completion, The Rex Corporation plans to continue the manufacture of Ansonia's "Ankoseal" wire and cable at the Ansonia plant in Ashton.

★ ★ ★

The Rex Corporation has extensive experience in the field of high temperature insulation, control, and communication. Assets to be acquired from Ansonia include the lease of the recently constructed Ashton plant, and engineering and production facilities for the manufacture of plastic-covered wire and cable. Application of new capital to the long-established operations of Ansonia, the oldest manufacturer in the plastic wire and cable field, would result in substantially enlarged capacity for both Rex and Ansonia products.

Automatic Wire Prefeed

This prefeed maintains a loop of slack wire ahead of wire process-

ing equipment. A variable speed motor, which powers the feed rolls, is set to dereel wire at a rate slightly lower than the rate at which the wire is used, thus creating a slowly diminishing loop. When the wire straightens, lifting the dancer tube, which requires less than one-half ounce of force, the motor speeds up momentarily to regenerate a loop. It is designed to dereel 1/32″ O.D. to 5/16″ O.D. wire from reels up to 12″ wide and 18″ in diameter at infinitely variable speeds from 6 feet per minute to more than 300 feet per minute. Designed principally for use with the Eubanks Automatic Wire Cutter and Stripper, it may also be used with coil winders and other wire processing equipment. It is manufactured by **Eubanks Engineering Company,** 260 North Alien Avenue, Pasadena, Calif.

Wire Man to Head Controllers Institute Conference

Clarence W. Snyder, controller and assistant secretary, **John A. Roebling's Sons Corp.,** Trenton, N. J., is chairman of industry conferences for the 27th Annual National Conference of the **Controllers Institute of America.** The gathering, to be held October 19-22 in Chalfonte-Haddon Hall, Atlantic City, is sponsored by the Institute's Philadelphia Control.

★ ★ ★

Subjects to be discussed at the Conference include depreciation, direct costing, personnel development, records retention and corporation financing.

★ ★ ★

Established in 1931, the Institute is a non-profit management organization of controllers and finance officers from all lines of business — banking, manufacturing, distribution, utilities, transportation, etc.

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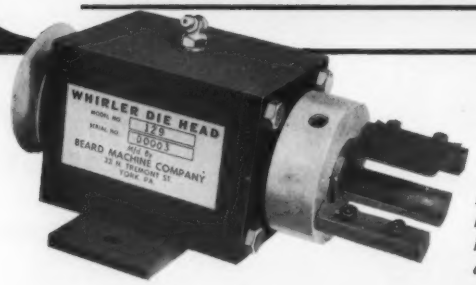

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Resistance to Corrosion of Aluminum Coated Steel Wire

(*Continued from page* 1372)

fence wire is performing satisfactorily and compares favorably with galvanized steel fencing in this respect.

Conclusions

By the use of adequate surface cleaning and fluxing techniques, hot dipped aluminum coated steel wire has now reached that stage of development where it is commercially available. The quality of the aluminum coating has been improved to such an extent during recent years that the resistance to corrosion of this product is now at least comparable to that of galvanized steel wire. In humid and industrial atmospheres, the inherent resistance to corrosion of aluminum coated steel appears superior to that of galvanized steel, while in seacoast atmosphere the performance of the two products is about equal.

★ ★ ★

Several accelerated tests to assist in predicting the service life of hot dip aluminum coated steel wire have been developed at Alcoa Research Laboratories. While each of these accelerated tests has merit, it is apparent that they should not be employed individually but rather in combination with other tests of a similar nature in order to predict the relative service life of this product accurately.

★ ★ ★

Hot dip aluminum coated steel wire, as now produced, is especially suitable for core wire in ACSR, primarily because of its compatibility with the aluminum conductor strands of this product. Other aluminum coated steel wire products have been developed, but apparently not to the extent that the core wire product has been.

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The New Galvanizing Line At Greenings

(*Continued from page* 1382)

And at lower left is a traverse section of the finished wire. In order to show the zinc coating the wire was encased in a piece of copper during the cutting and polishing operations. Magnification being x 200 this particular coating is approximately 0.0015".

★ ★ ★

The coat of zinc applied to the wire is exceptionally smooth and shows excellent adherence properties. The wire can be stretched to the breaking point with no apparent cracking or flaking off of the coat. The tenacious quality of this coat is attributed to the beneficial effects of the reducing atmosphere surface pre-treatment, prior to galvanizing and the keying action obtained with the sponge iron. Metallographic measurements of the coat shown have zinc depositions of approximately .00025 inches thick distributed uniformly around the circumference of the wire. The resultant coat runs by calculation to be on the order of 24 lbs. per 1000 lbs. of wire, for the size #18, or approximately 0.15 ounces per square foot of wire surface. The wire emerges with a bright smooth coat of excellent appearance.

★ ★ ★

As might be expected from any development project of this nature, experience gained in actual operation during the process of equipment "run-in" led to formulation of definite rules of operating the equipment to secure maximum

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benefits. For instance, it was found that for certain conditions of work, the original thinking of using a sub-critical anneal did not produce uniform enough results. Consequently, the equipment heating rates are adjusted to produce a full normalizing operation as required. Advance planning of equipment design parameters was broad enough to provide flexibility of operation to the degree required to suit production needs.

★ ★ ★

Estimated costs of operation and maintenance have fallen within initial predictions. Especially important is the fact that the equipment can be run by one operator. On overall basis, the new line produces galvanized wire at a cost saving of $1.42 per 100 lbs. of wire produced as compared with the formerly used batch annealing and subsequent acid flux galvanizing process.

★ ★ ★

Better quality, lower cost and more production objectives have all been realized in the new continuous low carbon steel wire annealing and galvanizing line at **The B. Greening Wire Company, Ltd.**, in Hamilton, Ontario.

New High Permeability Alloys Announced

Two new and one improved high permeability alloys have been developed by **The Carpenter Steel Co.**, Reading Pa., to meet the need for magnetic alloys with higher permeabilities particularly at low inductions. The three alloys are: HyMu "400", Vacumet HyMu "800" and HyMu "80".

★ ★ ★

The HyMu "400" is a nickel-molybdenum-iron alloy specially processed to provide minumum 60-cycle A.C. permeability of 35,000 at 40 gauss for 0.014" thick strip. Minimum permeability for 0.006" thick strip is 40,000 at 40 gauss.

★ ★ ★

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vacuum-melted nickel-molybdenum-iron alloy with a minumum permeability of 55,000 at 40 gauss. Its primary application will probably be as laminations or toroids.

★ ★ ★

Processing techniques have been improved so that magnetic permeability for HyMu "80" has reportedly been increased by 30% at 40 gauss for all strip of 0.020" thick or less. This 79% nickel, 4% molybdenum-iron alloy is now being offered with a minimum 60-cycle A.C. permeability of 26,000 at 40 gauss as cold rolled strip.

New Specification for Mild Steel Electrodes

Changes in the specification for mild steel electrodes are contained in a booklet "Specification for Mild Steel Arc Welding Electrodes" prepared by the **American Welding Society** and the **American Society for Testing Materials.**

★ ★ ★

Among the major changes in the specification are the following:

1. **Three new iron powder electrodes—two of which are low hydrogen electrodes.**
2. **New E70 mild steel classification containing six electrode types.**
3. **Certain electrodes can be listed now in the E70 Series as well as the E60 Series.**
4. **A new requirement has been added. Chemical requirements must be met with certain electrodes to ensure the deposition of mild steel weld metal.**
5. **In the appendix two very useful tables have been added: Table A shows the mechanical properties to be expected in the as-welded condition and Table B gives a comparison of current ranges.**

★ ★ ★

Changes in mild steel electrode specifications are important since at least 80% of all welding is done with mild steel electrodes. The new specification is a great advance on the previous issue and will be welcomed by all users of mild steel electrodes.

★ ★ ★

Copies of the booklet may be obtained from the Technical Department, American Welding Society, 33 West 39th St., New York 18, N. Y. at a cost of 50¢ each.

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Batch Type Aluminum Coating of Small Steel Parts

(*Continued from page* 1356)

the early stages of exposure and gradually lessens.

★ ★ ★

Even at a temperature of 1600°F an aluminum coating of adequate thickness prevents oxidation of steel for long periods of time. Figure 12 shows a group of samples after exposure to 1600°F for 1000 hours. All specimens are 2 x ¼ x 4½ inches, made from the same bar of C1020 steel. Specimen 0 has no coating, Specimen 1 a 0.0017 inch coating, Specimen 3 a 0.0023 inch coating and Specimen 4 a 0.0025 inch coating. Obviously the thin coating of Specimen 1 was not of sufficient thickness to protect the steel for 1000 hours. There was just not enough aluminum available for diffusion for adequate protection.

★ ★ ★

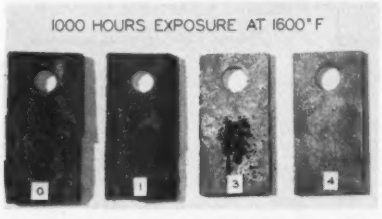

Fig. 12—Specimens After 1000 Hours at 1600°F.

The iron-aluminum alloy layer "as-coated" is composed of roughly 60% aluminum which slowly diffuses at high temperatures. At about 8% aluminum the coating no longer can prevent scaling. Specimen 3 just has reached this point and has started to scale. On the other hand, Specimen 4 shows no scaling whatsoever after 1000 hours at 1600°F in air.

★ ★ ★

A resume of some high-temperature test results of C1020 aluminum-coated steel is given in the following table. An increase in weight, indicated by a plus, results from oxidation of the aluminum coating. A loss in weight is indicated by a minus.

RESISTANCE OF ALUMINUM-COATED STEEL TO HIGH-TEMPERATURE CORROSION

Aluminum Dip Times Minutes	% Change in Weight After 1000 Hrs. at Temperature* 990°F	1200°F	1600°F
0	—2.2	—26.3	—100.0**
1			—37.2
2	+0.02	+0.13	
3			—0.7
4 to 8	+0.02	+0.13	+0.4

*After removal of all scale.
**Uncoated specimen was 100% oxidized after about 800 hours.

★ ★ ★

Aluminum coating by no means is the panacea for all corrosion problems but it definitely fulfills some of our constantly expanding need for inexpensive high-strength fasteners with improved corrosion resistance.

Acromark Hot Stamping Machine

A supplemental hot stamping head has been constructed and is offered by **The Acromark Company,** 423 Morrell St., Elizabeth, N. J. to extend the capacity of their Model 250H Acroleaf Press. This head is offered as optional equipment on new processes and is available to owners of the Standard Model 250H. The new head, which is interchangeable with the standard, provides an increased stamping area of up to 12" length by 2½" width. A scrap roll-leaf rewind is provided to keep the work area clear and to eliminate down time taken to chop used foil.

★ ★ ★

For hot stamping in gold, silver, or any color on large areas, such as book covers, signs, rollers, name-plates, instruction plates, scales, instruction charts, calibrated parts and various other products that require marking up to 12" lengths, the Acroleaf Model 250H-12 is ideal.

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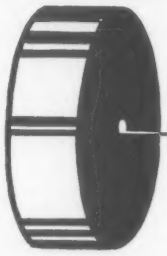

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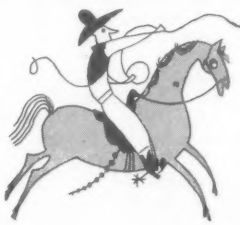

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Aluminum Coating of Steel Wire

(*Continued from page* 1351)

than has been proposed for the A.S.T.M. specification for Aluminized Core Wire.

★ ★ ★

We have been successful in producing coatings on .062" diameter wire and smaller, which can be wrapped on their own diameter without flaking. This has been done by controlling the time of immersion, the temperature of the bath and by using an aluminum alloy containing silicon.

★ ★ ★

The primary concern in hot dip aluminizing are the minute black spots in the surface of the wire. These areas are not coated and generally are so small that they are not readily observed by the naked eye. These surface defects, however, show up very distinctly when the wire is exposed to a corrosive atmosphere. The elimination of these defects has been a major problem and has been the reason why the commercial development of aluminum coated wire has been slow.

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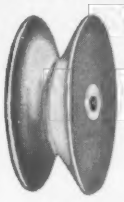

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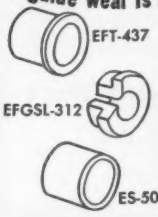

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The Wickwire Spencer Steel Division of **The Colorado Fuel and Iron Corporation** moved its New Orleans District Sales Office on September 22, it was announced by **H. C. Allington,** vice president in charge of sales.

★ ★ ★

The new address is 1128 Dublin at Oak Street, New Orleans 18, La., and the new phone number is UNiversity 1-3656. The old address was 7930 Palm Street.

New Electrical Metallic Tubing Bulletin

Product uses, features, and manufacturing processes of electric metallic tubing by **Rome Cable Corporation** are detailed in a new 12-page bulletin, now available without charge.

★ ★ ★

Bulletin RCP-900 gives a complete story of electrical metallic tubing as produced in Rome Cable's Torrance, California, plant.

★ ★ ★

Recommended applications for the color-coded lightweight (thinwall) raceways for protecting electrical wiring systems are outlined for residential, commercial, institutional and industrial construction, where heavier rigid conduit is not required.

★ ★ ★

Charts are included which detail the number of cables (according to AWG wire sizes and types of insulation) that each Rome conduit size will accommodate.

★ ★ ★

Copies of the bulletin are available from: Publications Division, Rome Cable Corporation, Rome, N. Y.

Polyethylene Technology Covered in New USI Handbook

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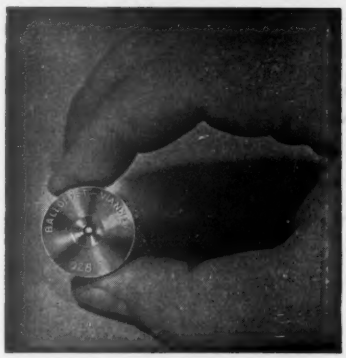

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published by **U.S. Industrial Chemicals Co.** "Petrothene* Polyethylene—A Processing Guide" is believed to be the first work designed to tell the complete story of polyethylene in a single publication with a minimum of repetitive detail and highly technical jargon.

★ ★ ★

Written in a readable and easily understood manner, the booklet covers every significant aspect of polyethylene processing techniques. A blend of old and new data, it goes into considerable detail on many specific problems which confront the processor and the steps that can be taken to avoid or correct them. Some subjects, which in general have been well covered elsewhere, however, are discussed only briefly.

★ ★ ★

A discussion of properties of polyethylene resins is tied together in a practical way to information on end products and the techniques for producing them. Through this correlation of facts the booklet points out that quality control is the joint responsibility of resin supplier and processor. There are also sections dealing with a general description of polyethylene as a member of the plastics family; uniformity, compounding and blending of polyethylene resins; and packaging and shipping of Petrothene resins.

★ ★ ★

Illustrated with a wide variety of charts, tables and photographs, the booklet is expected to find use both as an aid to polyethylene processors and as a helpful manual for newcomers to the field. A minimum of specific information on U.S.I. resins is contained in the booklet. This type of data, which is ever-changing due to the introduction of new resins, is presented

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in a separate brochure to avoid rapid obsolescence of the new processing guide.

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Alumoweld Wire A New Aluminum Coated Steel Wire With a Thick Coating

(*Continued from page* 1364)

together with its high electrical conductivity and its excellent corrosion resistance makes Alumoweld wire and strand ideal materials for electrical transmission and distribution lines. When combined with solid aluminum wires in composite strands, a wide range of strength and conductance characteristics is possible as is indicated in Figure No. 8. In addition to these uses on overhead lines, there are undoubtedly many mechanical applications where the service conditions require a heavy coating of aluminum with a mild steel core. Preliminary work in this direction looks very promising.

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F-S Appointments

Firth Sterling, Inc. announces the following appointments to its sales organization.

★ ★ ★

Kenneth E. McKown is a sales representative in the Pittsburgh District Sales and will cover the Buffalo, Rochester and Elmira territory. He was formerly superintendent of the Tool Bit and Chromium Carbide Departments.

★ ★ ★

Robert B. Ahart has been appointed to Southwest District and will represent Firth Sterling in the Dallas, Texas area. He was formerly with Tool Supply & Engineering Company in Dallas.

★ ★ ★

Robert C. Wilkison has been assigned to the Southern District to cover the Florida, Georgia and South Carolina territory.

Oakite Names Vice President of Industrial Sales

Eustace Lingle, of 345 Crest Road, Ridgewood, N. J., has been named vice president in charge of industrial sales and education for **Oakite Products, Inc.,** manufacturers of industrial cleaning and metal treating compounds.

★ ★ ★

Mr. Lingle joined Oakite in 1929. After serving in several positions in the sales department, he was elected to the board of directors in 1939, and named vice president in 1953. He has now been given additional responsibilities in sales, sales planning, and technical education.

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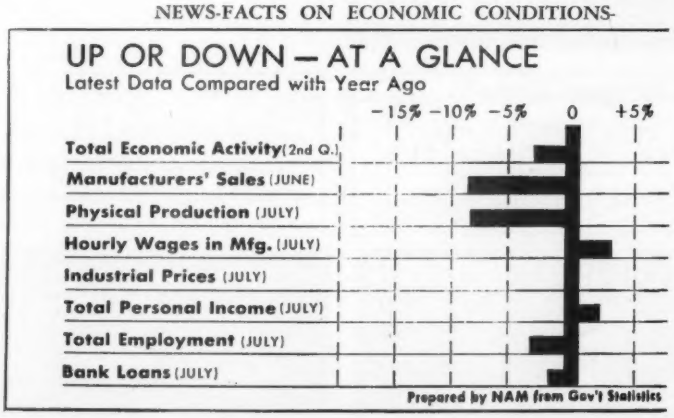
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CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CLEANERS—Metal
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

CLOTH—WIRE, All Metals
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
United States Borax & Chemical Corp., Div. Pacific Coast Borax Co., New York, N. Y.

COLOR CONCENTRATES— For Wire Coatings
Blane Corporation, The, Canton, Mass.
Century Products Co., Detroit, Mich.

COMPOUNDS—Coppering
Amchem Products, Inc., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago
Rusch Wire Die Corporation, Croton-on-Hudson, N. Y.

COMPOUNDS—Extrusion, for Wire
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.

COMPOUNDS—For Improving Drawing & Extrusion
Amchem Products, Inc., Ambler, Pa.

COMPOUNDS—Metal Finishing
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Phosphate Coating
Amchem Products, Inc., Ambler, Pa.

COMPOUNDS—Rust Preventing
Amchem Products, Inc., Ambler, Pa.
American Lanolin Corporation, Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Removing
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Vinyl
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
Chemical Products Corporation, East Providence, R. I.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.
United States Borax & Chemical Corp., Pacific Coast Borax Co. Div., New York, N. Y.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit

CUTTING TOOLS—Wire
Robinson, M. W. Co., Rockfall, Conn.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Research Co., St. Clair Shores, Mich
Rusch Wire Die Corp., Croton-on-Hudson, N. Y

DIAMOND TOOLS—
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit.

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES DIAMOND—Drawing Angle Controlled
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

DIES DIAMOND—Reversible
Indiana Wire Die Company, Fort Wayne, Indiana
National Wire Die Co., Inc., New York, N. Y

DIES—Extrusion
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelloy Corporation, New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass

DIES—Polishing, Asbestos Wire
Beard Machine Co., York, Pa.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.

Metal Carbides Corporation, Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Detroit
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Hillside, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Hoosier Wire Die., Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Metallurgical Products Dept. of General Electric Co., Detroit
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Electric, Adjustable Speed
Allis, The Louis Co., Milwaukee, Wisc.

DRUMS—Wire Packaging
Continental Can Company, Van Wert, Ohio
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FREQUENCY CHANGERS—
The Louis Allis Company, Milwaukee, Wisc.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Galvanizing Equipment
Electric Furnace Co., Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Offenbau Fritz G.m.b.H., Hagen i.W., W. Germany
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.
Offenbau Fritz G.m.b.H., Hagen i.W., W. Germany
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Resistance Heating, Strand
Electric Furnace Company, Salem, Ohio
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio

FURNACES—Strand Annealing
Ajax Electric Company, Philadelphia, Pa.
Electric Furnace Company, Salem, Ohio
Offenbau Fritz G.m.b.H., Hagen i.W., W. Germany
Sunbeam Corporation, (Industrial Furnace Division), Chicago, Ill.

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GEARMOTORS—
The Louis Allis Company, Milwaukee, Wisc.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—For Wire
Burlington Fabricators Inc., Products Div., Burlington, N. J.
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Chemical Products Corporation, East Providence, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS —
Apex Tire & Rubber Co., Pawtucket, R. I.
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
Thompson Chemical Company, Pawtucket, R. I.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

INSULATING MATERIALS—Paper (For Electric Wire Cable)
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.

LACQUERING SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The, Philadelphia and Bellefonte. Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N.Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Company, Harrison, N. J.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England
Larmuth and Bulmer, Limited, Manchester, England

MACHINERY—Bolt, Rivet, Screw, etc.
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Providence, R. I., Division of Wanskuck Co.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The. Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corporation, New York. N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Chain Making
Baird Machine Company, Stratford, Conn.
Larmuth and Bulmer, Limited, Manchester, England
Nilson, A. H. Machine Co., Shelton, Conn.
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Closing Rope
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls. O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Cold Heading
Behr Machinery & Equipment Corp., Rockford, Ill.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Herborn, Maschinenfabrik, Herborn, Germany
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden.
National Mach'y Exch (Used), New York
Steel & Wire Machinery Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Company, Worcester, Mass.
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Maschinenfabrik, Herborn, Germany
Wheelabrator Corporation, Mishawaka, Indiana

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark. N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Detroit
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J
Davis Electric Co., Wallingford, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Royle, John, & Sons, Paterson, N. J.

Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Steel Equipment Company, Cleveland, Ohio
Steel & Wire Machinery Co., Cleveland, Ohio
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Baird Machine Company, Stratford, Conn.
Nilson, A. H. Machine Co., Shelton, Conn.
Steel & Wire Machinery Co., Cleveland, Ohio

MACHINERY—Galvanizing Wire
Offenbau Fritz G.m.b.H., Hagen i.W., W. Germany
Steel & Wire Machinery Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Whitacre Engineering & Manufacturing Company, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Mfg. Co., Wallingford, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Beard Machine Co., York, Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia
Cook Mfg. Co., The, Paterson, N. J.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Patenting Wire
Offenbau Fritz G.m.b.H., Hagen i.W., W. Germany
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Hodge Bros. Machine Shop, Ossining, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York,
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Polishing Asbestos Wire
Beard Machine Co., York, Pa.

MACHINERY—Printing on Electric Wire
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M. Co., Inc., Boylston, Mass.

MACHINERY—Re-Spooling
Bartell Machine Tool Corp., Rome, N. Y.
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Colbourne Machine Company, Winsted, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
National Mach'y Exch. (Used), New York N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn, Maschinenfabrik, Herborn, Germany
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spooling Tension Controls
Web Controls Corp., West Englewood, N. J.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Staple
Baird Machine Company, Stratford, Conn.
Nilson, A. H. Machine Co., Shelton, Conn.

MACHINERY—Straightening & Cutting
American Laubscher Corporation, New York 19, N. Y.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel & Wire Machinery Co., Cleveland, Ohio
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth & Bulmer Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Düsseldorf-Rath, Germany
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Colbourne Machine Company, Winsted, Conn.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research Corporation, Mystic, Conn.
Entwistle, James L., Esmond, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Kraft, J. A., Maschinenfabrik, OLPE/Westf. Germany
Larmuth & Bulmer Limited, Manchester, England
Litzler, C. A., Co., Inc., Cleveland, Ohio
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Pourtier Pere et Fils, Romainville (Seine) France
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Collins Bros. Machine Co., Wire & Cable Machy. Div., Pawtucket, R. I.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Federal Mfg. Co., Wallingford, Conn.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Offenbau Fritz G.m.b.H., Hagen i.W., W. Germany
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—Welded Wire Mesh
National Electric Welding Machines Co., Bay City, Michigan
Schlatter, Ltd., H. A., Zollikon/Zurich

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery —Welding Wire Fabrics)

MACHINERY—Winding Wire
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle, James L., Esmond, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Kraft, J. A., Maschinenfabrik, OLPE/Westf., Germany
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York 19, N. Y.

Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Federal Mfg. Co., Wallingford, Conn.
Herborn, Maschinenfabrik, Herborn, Germany
Hodge Bros. Machine Shop, Ossining, N. Y.
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Wire and Machinery Co., Cleveland, Ohio
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wartenweiler, Emilio, Milan, Italy
Waterbury-Farrel Fdry. & Mach. Co., Division of Textron Inc., Waterbury, Conn.
Whitacre Engineering & Manufacturing Company, Alhambra, California

MACHINERY—Wire Forming
Baird Machine Company, Stratford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Shelton, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Company, Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS—Electric, A.C. — D.C.
The Louis Allis Company, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Company, Winsted, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAINT BONDING CHEMICALS—
Amchem Products, Inc., Ambler, Pa.

PAINTS—Heat Resisting
Amchem Products, Inc., Ambler, Pa.

PAPER—Creped Wrapping
Ludlow Papers, Inc., Needham Heights, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Ludlow Papers, Inc., Needham Heights, Mass.

PAPER—Insulating
Ludlow Papers, Inc., Needham Heights, Mass.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PATENT—ATTORNEYS—
Rommel, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Cary Chemicals, Inc., New Brunswick, N. J.
Monsanto Chemical Company, Plastics Division, St. Louis, Mo.

PLASTICS—for Wire Insulation
Apex Tire & Rubber Co., Pawtucket, R. I.
Blane Corporation, The, Canton, Mass.
Cary Chemicals, Inc., New Brunswick, N. J.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Shawinigan Resins Corporation, Springfield, Mass.
Thompson Chemical Company, Pawtucket, R. I.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, New York, N. Y.

PRINTING WHEELS—for Electric Wire
Frank Daniels & Co., New York, N. Y.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M. Co. Inc., Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

RACKS—Wire Storage
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Mettler Machine Tool, Inc., New Haven, Conn.
Northern Indiana Steel Supply Co., Inc., Michigan City, Indiana
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Evans, George, Corp., Moline, Ill.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
New York Engineering Corp., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Steel, for Rope and Cable
Evans, George, Corp., Moline, Ill.
New York Engineering Corp., Yonkers, N. Y.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Boonton Molding Company, Boonton, N. J.
Bridge Mfg. Co., The, Hazardville, Conn.
Burlington Fabricators, Inc., Products Div., Burlington, N. J.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Molded Fiber Glass Tray Co., Linesville, Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Nilson, A. H. Machine Co., Shelton, Conn.
Republic Steel Corp., Pressed Steel Div., Cleveland, Ohio
Richard-Stuart Manufacturing Corp., Phila., Pa.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Seymour & Peck Div., The Greif Bros. Cooperage Corp., Chicago, Ill.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Aluminum Company of America, Pittsburgh, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Pittsburgh Steel Co., Pittsburgh, Pa.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SATURATION SYSTEMS—
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—Plastic
Boonton Molding Company, Boonton, N. J.
Hubbard Spool Company Div., The American Pulley Co., Garrett, Ind.
Molded Fiber Glass Tray Co., Linesville, Pa.
National Vulcanized Fibre Co., Lestershire Spool Div., Johnson City, N. Y.
Plastic Mold & Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS
Jarke Manufacturing Co., Chicago, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TABLES—Press Feeding

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H., Hagen i.W., W. Germany.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TESTERS—INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

WHERE TO BUY, Continued

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Hodge Bros. Machine Shop, Ossining, N. Y.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Shawinigan Resins Corporation, Springfield, Mass.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila, Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WAXES—for Insulated Wire
Cary Chemicals, Inc., New Brunswick, N. J.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
Micro Products Co., Chicago, Ill.
National Electric Welding Machines Co., Bay City, Michigan
H. A. Schlatter, Ltd., Zollikon-Zurich

WHEELS—for Printing on Electric Wire
Frank Daniels & Co., New York, N. Y.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co. Inc., Boylston, Mass.

WIRE—Aluminum
Aluminum Company of America, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Clad and Plated
Sylvania Electric Products Inc., Warren, Pennsylvania

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Malin & Co., The, Cleveland, Ohio
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
Aluminum Company of America, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Montgomery Co., The, Windsor Locks, Conn.
National Standard Company, Niles, Mich.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
Aluminum Company of America, Pittsburgh, Pa.
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corporation, Pressed Steel Div., Cleveland, Ohio
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Metalizing
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Worcester Wire Works Div., National-Standard Company, Worcester, Mass.

WIRE—Needle
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Continental Steel Corp., Kokomo, Ind.
National Lock Washer Company, The, Newark, N. J.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Sylvania Electric Products Inc., Warren, Pennsylvania
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Roebling's John A., Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Firth Sterling, Inc., Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Steel—Also Coppered and Galvanized Steel
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Porter Company, Inc., H. K., Riverside—Alloy Metal Division, Riverside, N. J.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Division, Armco Steel Corporation, Kansas City, Mo.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
American Chain & Cable, Page Steel and Wire Division, Monessen, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

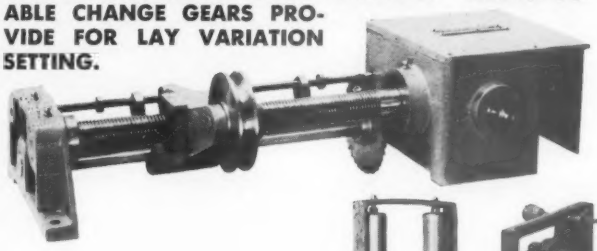
WATSON

AUTOMATIC TRAVERSES

STANDARD STOCK MODELS SHOWN. SUITABLE AS REPLACEMENTS OF INADEQUATE MECHANISMS. SUITABLE FOR APPLICATIONS WHERE A POWERFUL RECIPROCATING MOTION IS REQUIRED.

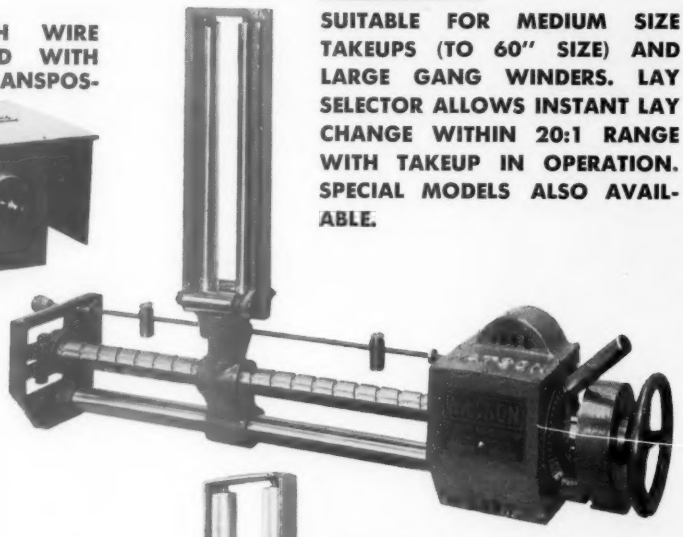
TRAVERSE "E"

CAPABLE OF FUNCTIONING AT HIGH WIRE TENSIONS AND COMMONLY FURNISHED WITH SMALL STRANDERS AND WINDERS. TRANSPOSABLE CHANGE GEARS PROVIDE FOR LAY VARIATION SETTING.



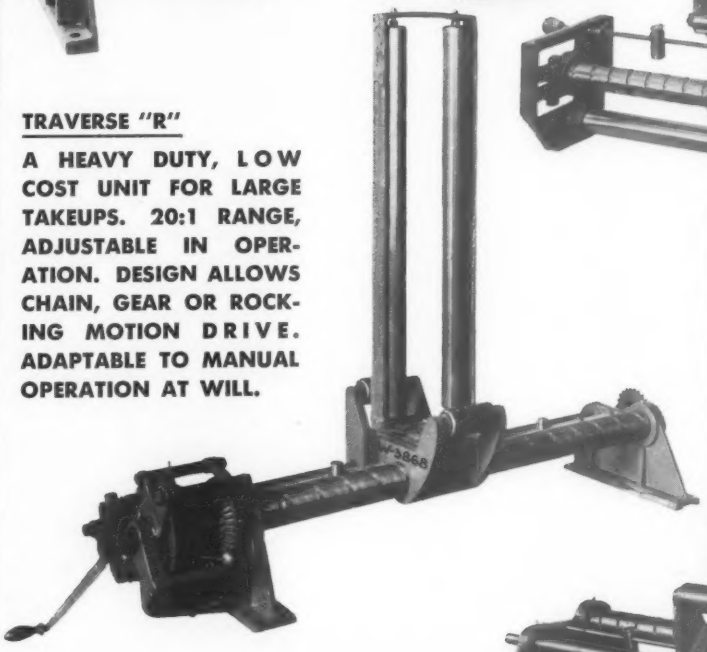
TRAVERSE "C"

SUITABLE FOR MEDIUM SIZE TAKEUPS (TO 60" SIZE) AND LARGE GANG WINDERS. LAY SELECTOR ALLOWS INSTANT LAY CHANGE WITHIN 20:1 RANGE WITH TAKEUP IN OPERATION. SPECIAL MODELS ALSO AVAILABLE.



TRAVERSE "R"

A HEAVY DUTY, LOW COST UNIT FOR LARGE TAKEUPS. 20:1 RANGE, ADJUSTABLE IN OPERATION. DESIGN ALLOWS CHAIN, GEAR OR ROCKING MOTION DRIVE. ADAPTABLE TO MANUAL OPERATION AT WILL.



TRAVERSE "W"

MOST VERSATILE HEAVY DUTY UNIT EVER DESIGNED. 20:1 RANGE, INSTANT SHIFT FROM AUTOMATIC TO HAND CONTROL AND VICE VERSA. ADAPTED FOR REMOTE CONTROL. SPECIAL EXTRA HEAVY DUTY MODEL "WW" AVAILABLE.

ALL MODELS AND TYPES PROVIDED WITH RAPIDLY ADJUSTABLE END POINT SETTING STOPS. INTERCHANGEABLE ROLLER OR SHEAVE GUIDE PROVIDED TO SUIT REQUIREMENTS.

* * * *

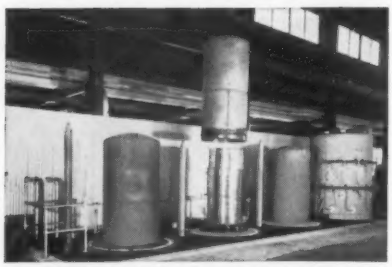
Details Upon Request

11-58

Part of an installation of large gas fired three-stack rectangular bell type forced circulation special atmosphere furnaces for annealing strip.

Bell Type FURNACES

Built to Suit Your Plant, Product or Process



Built right—over 20 years ago—this EF installation is still in operation, daily—and producing first class work.

EF direct gas fired forced circulation bell type furnace for processing wire, rod, strip and other products. The split cover design permits installing where head room is limited.

Single or multi-stack — circular, rectangular or square types — upright, elevator or partial pits — gas fired, oil fired or electric — correctly designed, built and installed, ready to produce.

Backed by over 40 years of practical furnace building experience, EF furnaces incorporate all the advantages of all bell type designs, for processing strip, wire, rod and other ferrous and non-ferrous products.

EF bell type furnaces installed over 20 years ago are still in service daily, producing first class work. After all, there's no substitute for experience. At your convenience EF experienced engineers will be pleased to discuss the best type for your specific requirements.

THE ELECTRIC FURNACE CO.

GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio

Canadian Associates • Canefco Limited • Toronto 13, Canada

EF direct gas fired special atmosphere forced circulation, single stack circular bell steel strip annealers, each accommodates three 48" x 40" 15,000 lb. coils (45,000 lbs.)

Part of another installation of large EF gas fired three-stack rectangular bell type forced circulation special atmosphere furnaces for annealing steel strip.

EF gas fired special atmosphere rectangular bell type strip annealers with individually controlled forced circulation three-stack bases each with capacity of 135,000 lbs. per charge.